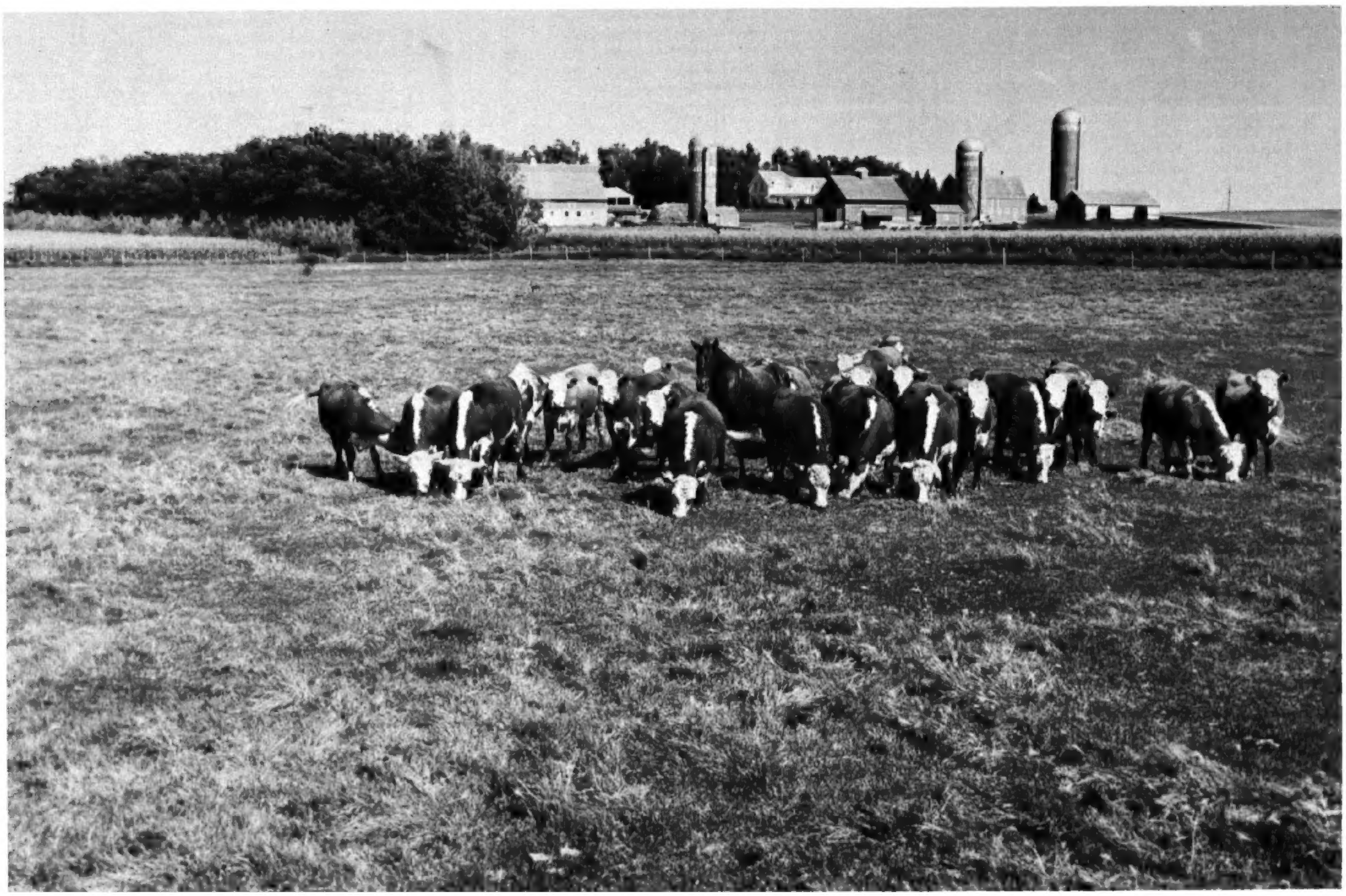
SOIL SURVEY OF

Lincoln County, South Dakota



United States Department of Agriculture
Soil Conservation Service
In cooperation with
South Dakota Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1961–70. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Lincoln Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Lincoln County are shown on the detailed map at the back of this publication. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol. It also shows the page where each kind of soil is described and the page for the capability unit, windbreak group, and pasture group in which the soil has been placed.

Individual colored maps that show the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and from the descriptions of the capability units, pasture groups, and windbreak groups.

Foresters and others can refer to the section "Woodland and Windbreaks," where the soils of the county are grouped according to their suitability for trees and shrubs.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others concerned with suburban development can read about soil properties that affect the choice of homesites, industrial sites, schools, and parks in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Lincoln County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Information About the County."

Cover: **Tame pasture on Alcester and Lamo silty clay loams in Lincoln County.**

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SOIL SURVEY OF LINCOLN COUNTY, SOUTH DAKOTA

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SOILS SURVEYED BY JAMES L. DRIESSEN, GRAYSON E. MURPHY, AND W. D. WIESNER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

LINCOLN COUNTY is in the southeastern part of South Dakota (fig. 1). It has a total area of 368,640 acres. Canton, the county seat, is the largest town. Other towns and villages are Fairview, Harrisburg, Hudson, Lennox, Tea, and Worthing. A small part of Sioux Falls, the largest city in South Dakota, extends into the northern edge of the county.

Elevation ranges from less than 1,300 feet along the Big Sioux River to about 1,500 feet on uplands. Most of the county is nearly level to gently undulating, but relief is gently undulating to strongly sloping in the southeastern and northwestern parts. Hilly to steep areas are adjacent to the bottom lands of the Big Sioux River and also along some of the creeks. Much of the county is drained by the Big Sioux River and its tributaries. Long Creek and other tributaries of the Vermillion River drain the west-central and southwestern parts of the county.

General livestock farming is the main type of farming in the county, and it is the main source of income. About 82 percent of the county is cropped. Corn, oats, soybeans, and alfalfa are the main crops. Barley, flax, rye, wheat, and tame grasses are also grown. Beef cattle and swine are the main types of livestock.

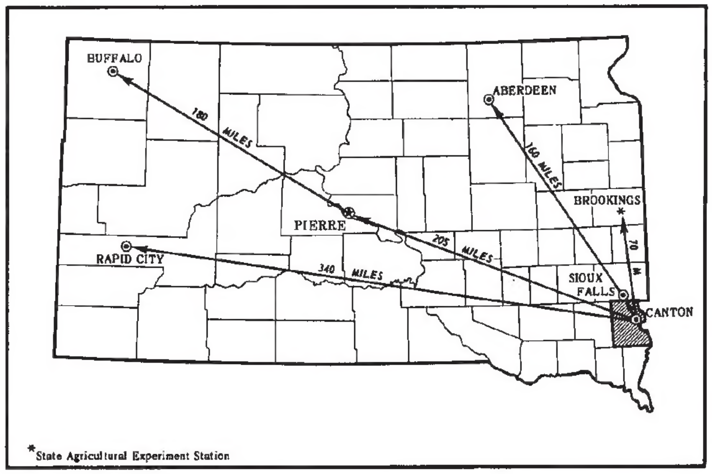

Figure 1.—Location of Lincoln County in South Dakota.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Lincoln County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and nature of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Alcester and Worthing, for example, are the names of two soil series. All the soils in the United States that have the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Dempster silt loam, 0 to 2 percent slopes, is one of two phases within the Dempster series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Lincoln County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Egan-Shindler complex, 2 to 6 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils or of two or more. If there are two or more dominant soils represented in the group, the name of the group ordinarily consists of the names of the dominant soils joined by "and." Alcester and Lamo silty clay loams is an undifferentiated group in Lincoln County.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Marsh is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Lincoln County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map that shows soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The boundaries of the soil associations in Lincoln County match those of the previously published survey of Minnehaha County, but there are some differences in the names because of changes in the soil classification system.

The soil associations in this survey have been grouped into four general kinds of landscapes for broad interpretative purposes. Each of the broad groups and their included soil associations are described in the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of the Wentworth-Chancellor association, the word "silty" refers to the texture of the surface layer.

Soils Formed in Glacial Drift and Glacial Till; on Uplands

The soil associations in this group consist of deep, well-drained silty and loamy soils that formed in glacial drift and glacial till. Moderately well drained to poorly drained soils are in swales and depressions scattered throughout the area. The soils are mostly nearly level to rolling, but hilly to steep soils are on breaks along the Big Sioux River and its tributaries.

These associations make up about 79 percent of the county.

Most areas are cultivated. The hilly to steep soils and some of the wetter soils are used for pasture, hay, wildlife habitat, or recreation. The nearly level, well-

drained soils have few limitations for crops. Wetness is a limitation on the more poorly drained soils. Control of erosion is a concern of management in other areas.

1. *Wentworth-Chancellor association*

Deep, well drained and somewhat poorly drained, nearly level, silty soils

This soil association is on smooth-appearing uplands and consists of very slight rises interspersed with many shallow swales and closed depressions. Slopes are mostly nearly level, but the sides of some drainageways are gently sloping or steeper.

The association (fig. 2) makes up about 36 percent of the county. It is about 55 percent Wentworth soils, 25 percent Chancellor soils, and 20 percent minor soils.

Wentworth soils are on very slight rises and are well drained. Their surface layer is dark grayish-brown silty clay loam. The subsoil is silty clay loam that is dark brown in the upper part, yellowish brown in the middle part, and light yellowish brown in the lower part. The underlying material is light brownish-gray, calcareous silty clay loam.

Chancellor soils are in swales and are somewhat poorly drained. Their surface layer is dark-gray silty clay loam. The subsoil is silty clay that is dark gray in the upper part and olive gray in the lower part. The underlying material is light olive-gray and gray, calcareous silty clay loam.

Minor in this association are Egan soils on slightly

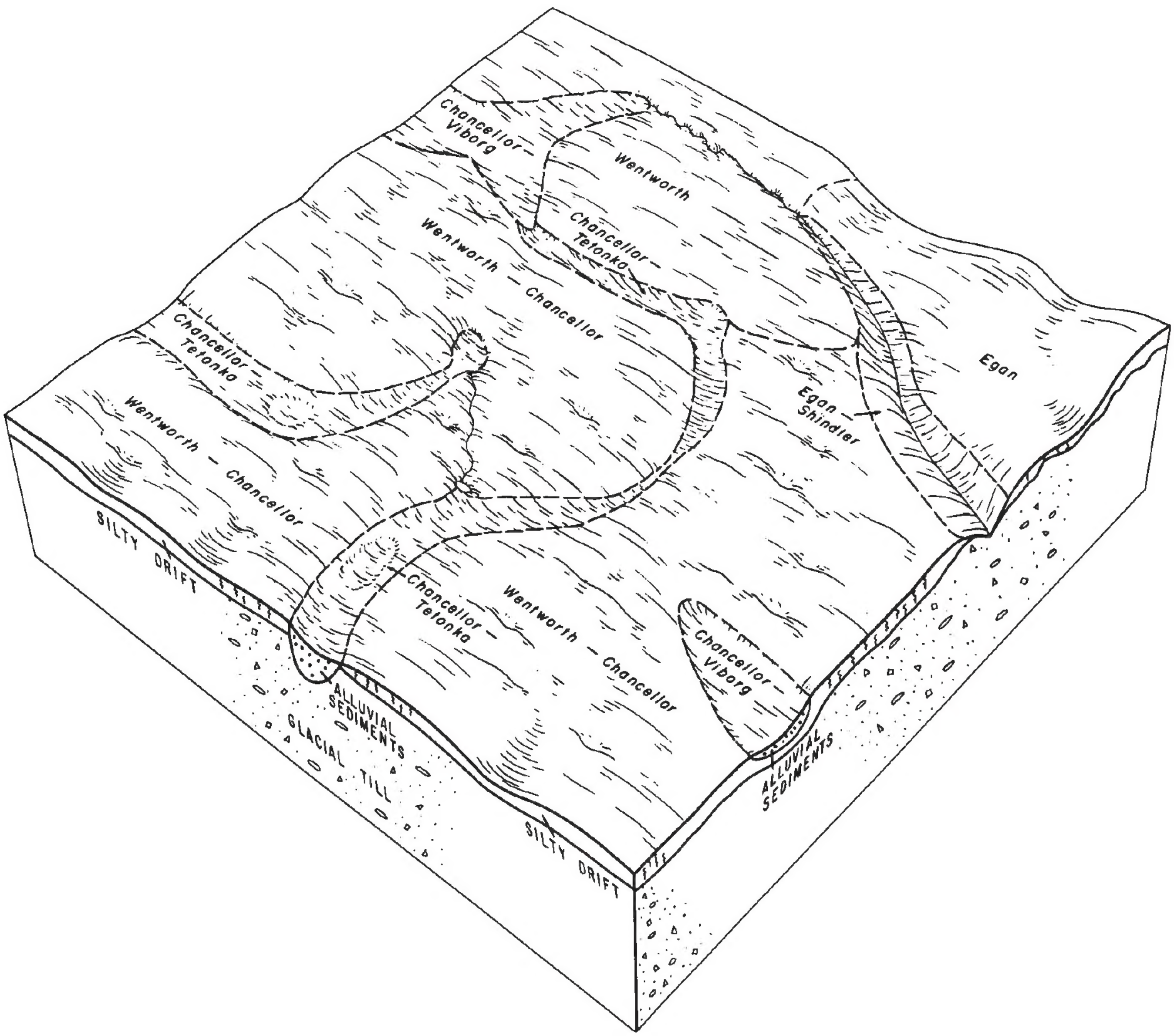

Figure 2.—Pattern of soils, topography, and underlying material in association 1.

rounded swells, Lamo and Salmo soils on narrow bottom lands, Shindler soils on the sides of entrenched drainageways, Tetonka soils in depressions, Viborg soils in some of the swales, and Wakonda soils on rims around the depressions or on the edges of swales.

Fertility and organic-matter content are high in the major soils of this association. Available water capacity is high. Runoff is slow and collects in the swales and depressions. The hazards of water erosion and soil blowing are slight. Wetness commonly delays farming operations on the Chancellor soils. The Wentworth soils have only slight limitations for crops. Wetness and maintenance of tilth on the Chancellor soils are the main concerns of management.

This association has high potential for cultivated crops and for pasture and hay. Almost all of it is cultivated. Corn, oats, soybeans, and alfalfa are the main crops. Pastures are small and commonly are near the farmsteads.

2. *Egan-Shindler-Worthing association*

Deep, well-drained, gently sloping to rolling, silty and loamy soils; and poorly drained, level, clayey soils

This soil association is on gently undulating to rolling uplands. Many potholes or closed depressions occur throughout the association. Local relief ranges from 10 to 30 feet. Slopes commonly are short in the higher parts of the landscape and on the sides of drainageways.

This association makes up about 11 percent of the county. It is about 40 percent Egan soils, 20 percent Shindler soils, 20 percent Worthing soils, and 20 percent minor soils.

Egan soils are mostly gently sloping and are well drained. Their surface layer is dark grayish-brown silty clay loam. The subsoil is silty clay loam that is dark brown in the upper part and grayish brown in the lower part. The underlying material is grayish-brown and light yellowish-brown, calcareous clay loam.

Shindler soils are in the higher parts of the landscape and on the sides of drainageways. They commonly have short and well-rounded slopes, and they are well drained. Their surface layer is dark-gray clay loam. The subsoil is calcareous clay loam that is dark gray and grayish brown in the upper part and light olive brown in the lower part. The underlying material is light yellowish-brown, calcareous clay loam.

Worthing soils are level. They are in depressions and are poorly drained. Their surface layer is very dark gray silty clay. The subsoil is silty clay that is very dark gray in the upper part and dark gray in the lower part. The underlying material is dark-gray, calcareous silty clay.

Minor in this association are Alcester soils on fans and bottom lands along drainageways, Chancellor and Viborg soils in swales, Huntimer soils on nearly level hilltops, Wakonda soils on rims around depressions, and Wentworth soils intermingled with Egan soils. Areas of Marsh are in some of the wetter and more deeply entrenched depressions.

Fertility and organic-matter content are high in the Egan soils. Fertility is medium in the Shindler soils, and in eroded areas it is low. Runoff is medium and ponds in areas of Worthing soils. Control of water erosion on the Egan and Shindler soils and improvement of drainage and tilth on the Worthing soils are the main concerns of management.

Most of this association is cultivated. Corn, soybeans, oats, and alfalfa are the main crops. Some of the steeper areas and the undrained depressions are used for pasture and wildlife habitat. The main enterprises are cash crops, beef cattle, and hogs.

3. *Egan-Chancellor association*

Deep, well drained and somewhat poorly drained, mainly gently undulating or gently sloping, silty soils

This soil association is on uplands. It consists of rises or swells interspersed with many swales and small depressions. Slopes are mostly gently undulating or gently sloping, but some are nearly level and some are undulating to rolling along the larger drainageways. Slopes that border the depressions and swales are short, but on some of the rises they are longer. Local relief ranges from 4 to 20 feet.

This association (fig. 3) makes up about 22 percent of the county. It is about 40 percent Egan soils, 25 percent Chancellor soils, and 35 percent minor soils.

Egan soils are gently sloping. They are on rises and are well drained. Their surface layer is dark grayish-brown silty clay loam. The subsoil is silty clay loam that is dark brown in the upper part and grayish brown in the lower part. The underlying material is grayish-brown and light yellowish-brown, calcareous clay loam.

Chancellor soils are in swales and slight depressions and are somewhat poorly drained. Their surface layer is dark-gray silty clay loam. The subsoil is silty clay that is dark gray in the upper part and olive gray in the lower part. The underlying material is light olive-gray and gray, calcareous silty clay loam.

Minor in this association are Lamo soils on narrow bottom lands along drainageways, Shindler soils on the sides of entrenched drainageways, Tetonka and Worthing soils in depressions, Viborg soils in some of the swales, Wakonda soils on the rims of depressions, and Wentworth soils in areas where slopes are smooth and nearly level.

Fertility and organic-matter content are high in the major soils of this association. Available water capacity is high. Runoff is medium and collects in the swales and depressions. Wetness commonly delays farming operations on the Chancellor soils. Control of water erosion on the Egan soils and improvement of drainage and maintenance of tilth on the Chancellor soils are the main concerns of management.

This association has a high potential for crops and for pasture and hay. Most of it is cultivated. Corn, soybeans, oats, and alfalfa are the main crops. Some of the undrained wet areas are used for pasture.

4. *Chancellor-Wakonda-Tetonka association*

Deep, moderately well drained to poorly drained, nearly level and level, silty soils

This soil association is on flat-appearing uplands. It consists of swales separated by convex humps that rise 1 foot to 3 feet above the swales. Many closed depressions occur throughout the association. Slopes

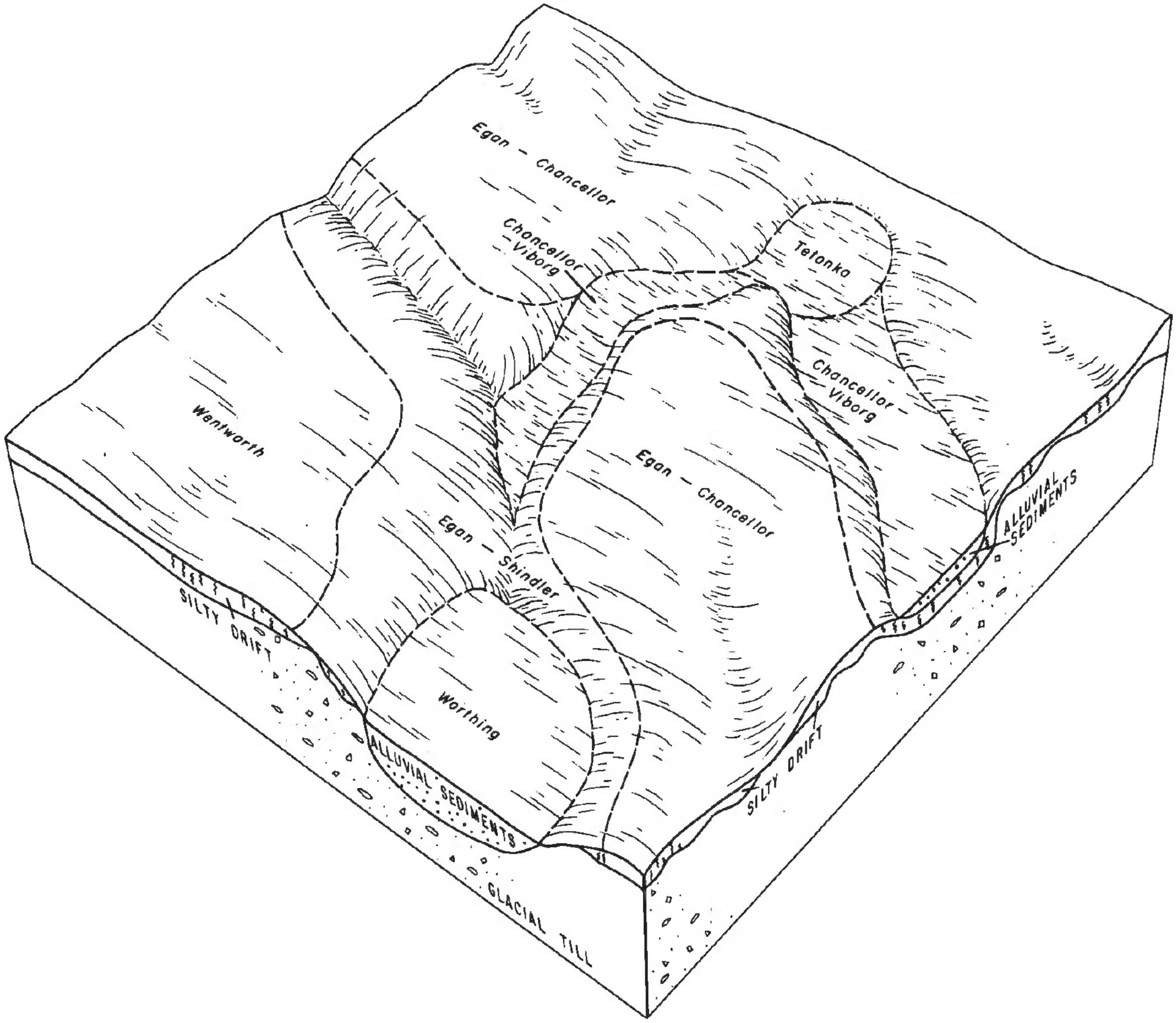

***Figure 3.*—Pattern of soils, topography, and underlying material in association 3.**

are mostly nearly level, but the closed depressions are level. A few drainageways head in the area, but otherwise the drainage pattern is ill defined.

This association makes up about 7 percent of the county. It is about 35 percent Chancellor soils, 25 percent Wakonda soils, 25 percent Tetonka soils, and 15 percent minor soils.

Chancellor soils are in swales and are somewhat poorly drained. Their surface layer is dark-gray silty clay loam. The subsoil is silty clay that is dark gray in the upper part and olive gray in the lower part. The underlying material is light olive-gray and gray, calcareous silty clay loam.

Wakonda soils are on the convex humps and are moderately well drained. They have a surface layer of dark-gray, calcareous silt loam. The next layer is light brownish-gray, calcareous silt loam. Below a depth of 31 inches, the underlying material is light yellowish-brown, calcareous silty clay loam that has spots and streaks of gypsum.

Tetonka soils are in depressions and are poorly drained. They have a surface layer of dark grayish-brown silty clay loam and a subsurface layer of gray silt loam. The subsoil is dark-gray silty clay. The underlying material is calcareous clay loam that has spots and streaks of gypsum and lime.

Minor in this association are Lamo and Salmo soils on narrow bottom lands along drainageways, Viborg soils intermingled with Chancellor soils, Wentworth soils on some of the slight rises, and Worthing soils in some of the closed depressions.

Fertility is high in the Chancellor soils. Growth of deep-rooted crops on the Wakonda soils is affected by salts in the lower part of the profile. Runoff is slow, and water ponds in the closed depressions. Wetness commonly delays farming operations and limits growth

of crops during wet years. Improvement of drainage is the main concern of management.

Most of the association is cultivated. Corn, soybeans, oats, and alfalfa are the main crops. Late-planted crops are better suited than others during wet years. Undrained soils in depressions are better suited to pasture and hay than to other uses.

5. *Shindler-Steinauer-Renner association*

Deep, well-drained, hilly to steep, loamy soils

This soil association is on uplands. It consists of breaks and the sides of valleys of the Big Sioux River and some of its tributaries. Slopes are mostly hilly to steep and commonly are dissected by short drainageways or draws.

This association makes up about 3 percent of the county. It is about 55 percent Shindler soils, 15 percent Steinauer soils, 10 percent Renner soils, and 20 percent minor soils.

Shindler soils have plane to convex slopes. Their surface layer is dark-gray clay loam. The subsoil is clay loam that is dark gray and grayish brown in the upper part and light olive brown in the lower part. The underlying material is light yellowish-brown, calcareous clay loam.

Steinauer soils are on the higher, steeper parts of the landscape and have convex slopes. They have a thin surface layer of dark-gray, calcareous clay loam. Below this is a thin layer of grayish-brown, calcareous clay loam. The underlying material is light brownish-gray, calcareous clay loam.

Renner soils are on step-like benches and along drainageways. They have a thick surface layer of dark-gray loam. The subsoil is clay loam that is dark gray in the upper part, dark grayish brown in the middle part, and light olive brown in the lower part. The underlying material is light olive-brown, calcareous clay loam.

Minor in this association are Alcester soils on bottom lands along the larger drainageways; Crofton, Nora, and Talmo soils on well-rounded ridges; and Egan soils on the wider ridgetops.

Fertility is low in the Steinauer soils and high in the Renner soils. Runoff is rapid on much of this association, and the hazard of erosion is very severe. Control of water erosion is the main concern of management.

Nearly all of this association is in native grass or trees and is used for pasture, woodland, wildlife habitat, and recreation. Farmsteads are mostly in adjacent soil associations. Posts, poles, and saw logs are harvested from some of the woodland. The wooded areas provide habitat for wildlife. Newton Hills State Park, which is in this association, is excellent for recreation.

Soils Formed in Loess; on Uplands

The soil associations in this group consist mainly of deep, well-drained, silty soils that formed in loess. Moderately well drained soils are on fans and narrow bottom lands along small streams and drainageways. Slopes commonly are long and smooth and range from nearly level to strongly sloping.

These associations make up about 14 percent of the county.

Most areas are cultivated. Some are moderately to severely eroded. Control of erosion is a major concern.

6. *Moody-Nora-Alcester association*

Deep, well drained and moderately well drained, nearly level to sloping, silty soils

This soil association is on uplands. Slopes are long and smooth and are mostly gently sloping. Steeper slopes are on the sides of the larger drainageways. The drainage pattern is well defined.

This association (fig. 4) makes up about 9 percent of the county. It is about 55 percent Moody soils, 15 percent Nora soils, 15 percent Alcester soils, and 15 percent minor soils.

Moody soils are nearly level to sloping. They have plane to slightly concave slopes and are well drained. Their surface layer is dark grayish-brown silty clay loam. The subsoil is dark grayish-brown silty clay loam in the upper part and pale-brown silt loam in the lower part. The underlying material is light yellowish-brown, calcareous silt loam.

Nora soils are gently sloping to sloping. They have mostly convex slopes and are well drained. They have a surface layer of dark grayish-brown silty clay loam and a subsoil of pale-brown silt loam. The underlying material is light yellowish-brown, calcareous silt loam.

Alcester soils are on narrow bottom lands and fans along drainageways. These soils are moderately well drained. They have a thick surface layer of dark-gray silty clay loam and a subsoil of dark grayish-brown silty clay loam. The underlying material is grayish-brown and light yellowish-brown, calcareous silty clay loam.

Minor in this association are Crofton soils on the tops and upper sides of some of the ridges and Lamo soils on bottom lands.

Except in eroded areas, fertility is high or medium in the major soils of this association. Available water capacity is high. Runoff is medium on most of the association. Control of water erosion and soil blowing is the main concern of management.

This association has a high potential for crops and for pasture and hay. Nearly all of it is cultivated. All crops grown in the county are well suited to the soils in this association. Pastures are small and commonly are close to the farmsteads.

7. *Nora-Moody-Crofton association*

Deep, well-drained, gently sloping to strongly sloping, silty soils

This soil association is on uplands. Slopes are long and smooth and are mostly convex and sloping to strongly sloping. Numerous drainageways occur throughout the association, and the drainage pattern is well defined.

This association makes up about 5 percent of the county. It is about 30 percent Nora soils, 30 percent Moody soils, 20 percent Crofton soils, and 20 percent minor soils.

Nora soils have convex slopes that are mostly sloping to strongly sloping. They have a surface layer of dark grayish-brown silty clay loam and a subsoil of pale-brown silt loam. The underlying material is light yellowish-brown, calcareous silt loam.

Moody soils are mostly gently sloping to sloping. Their surface layer is dark grayish-brown silty clay

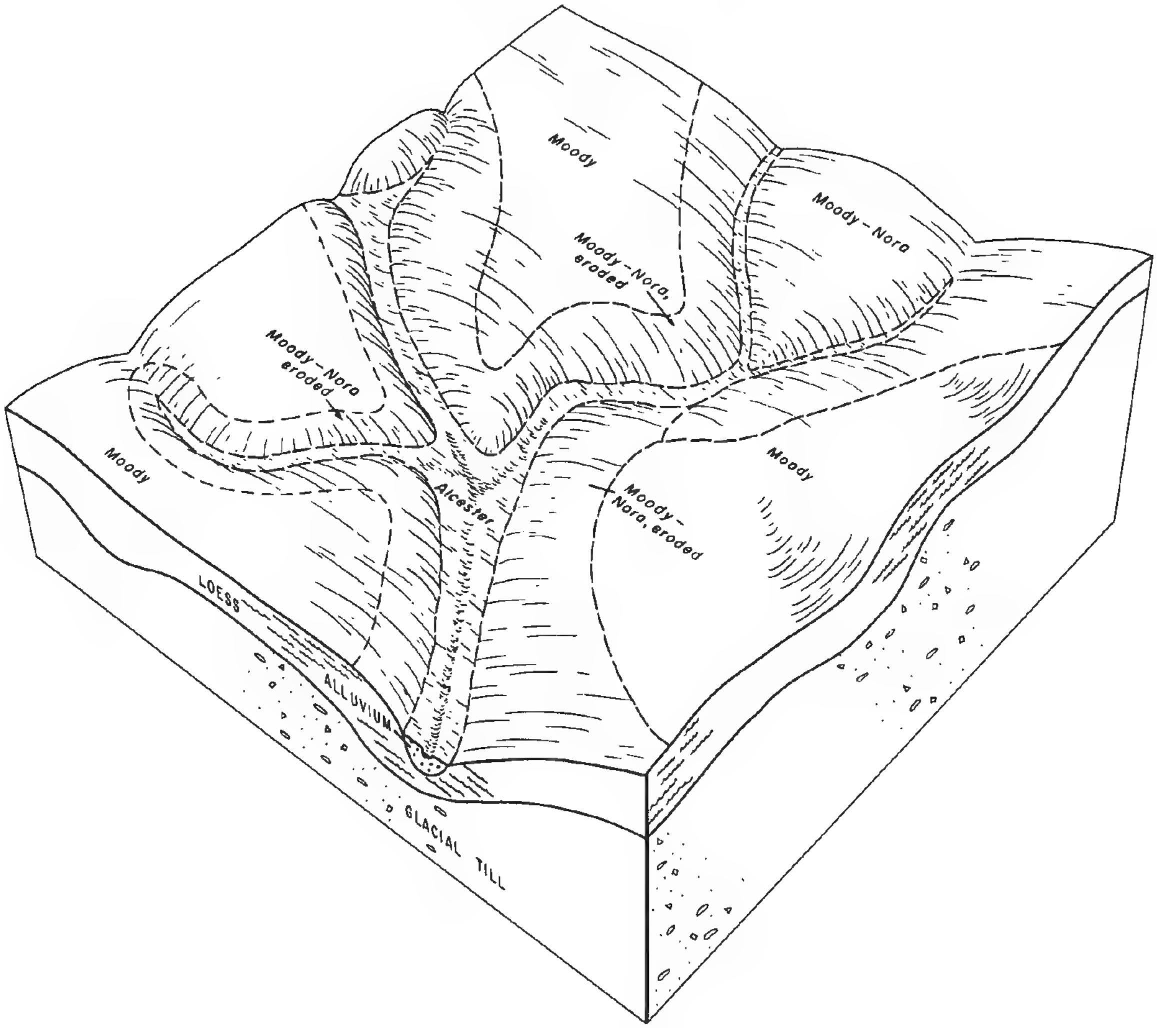

Figure 4.—**Pattern of soils, topography, and underlying material in association 6.**

loam. The subsoil is dark grayish-brown silty clay loam in the upper part and pale-brown silt loam in the lower part. The underlying material is light yellowish-brown, calcareous silt loam.

Crofton soils are mostly strongly sloping. They are on eroded ridgetops and the upper sides of entrenched drainageways. They have a surface layer of grayish-brown, calcareous silt loam. The underlying material is pale-brown and light yellowish-brown, calcareous silt loam.

Minor in this association are Alcester and Lamo soils on bottom lands.

Erosion has lowered the level of fertility in the major soils of this association. Runoff is medium to rapid. Control of water erosion and soil blowing and improvement of fertility and organic-matter content are the main concerns of management.

Most of this association is cultivated. The Moody and Nora soils are well suited to all crops grown in the county. The strongly sloping, eroded Crofton and Nora soils are better suited to pasture and hay than to other uses.

Soils Formed in Alluvium; on Bottom Lands

The one soil association in this group consists mainly of deep, moderately well drained to poorly drained, silty and loamy soils that formed in alluvium. These soils are on bottom lands and are subject to periodic flooding.

About half of the acreage is cultivated. Wetness from flooding and from a high water table is the main concern of management.

8. Lamo-Bon-Clamo association

Deep, moderately well drained to poorly drained, level and nearly level, silty and loamy soils

This soil association is on bottom lands along the larger streams in the county. Slopes are mostly level but are broken by old channels, meander scars, and secondary flood channels.

This assoication makes up about 3 percent of the county. It is about 40 percent Lamo soils, 20 percent Bon soils, 20 percent Clamo soils, and 20 percent minor soils.

Lamo soils are somewhat poorly drained. They have a very thick surface layer of very dark gray, calcareous silty clay loam. The underlying material also is very dark gray, calcareous silty clay loam.

Bon soils are nearly level and are moderately well drained. They have a very thick surface layer that is dark-gray loam in the upper part and dark grayish-brown, calcareous loam and fine sandy loam in the lower part. The underlying material is calcareous, stratified loam and fine sandy loam.

Clamo soils commonly are in the lowest parts of the landscape and are poorly drained. They have a surface layer of very dark gray silty clay loam and a subsoil of dark-gray silty clay loam and silty clay. The underlying material is gray and olive-gray, calcareous silty clay.

Minor in this association are Alcester soils on fans on the edges of stream valleys, Davis soils on low terraces, and Luton soils mostly along Long Creek where it joins the Vermillion River on the west county line.

The major soils in this association are subject to flooding from stream overflow and have a high water table. Fertility is high, but wetness commonly delays farming operations. Improvement of drainage, protection from flooding, and maintenance of tilth are the main concerns of management.

This association is used about equally for crops, pasture and hay. Corn, soybeans, oats, and alfalfa are the main crops in areas where drainage is adequate. If drainage is not adequate, the soils are better suited to late-planted crops or to pasture and hay than to other uses. Some areas are in native woodland and provide habitat for wildlife.

Soils Underlain by Sand and Gravel; on High Terraces

The soil associations in this group are on high terraces and consist of moderately well drained to excessively drained silty and loamy soils that are very shallow to deep over sand and gravel. Slopes range from nearly level to undulating.

These associations make up about 4 percent of the county.

Most of the acreage is cultivated. Some of the soils are droughty because of the underlying sand and gravel. Conservation of moisture is the main concern of management.

9. Graceville-Dempster association

Moderately well drained and well drained, nearly level to gently sloping, silty soils that are deep and moderately deep over sand and gravel

This soil association is mainly on high terraces along the Big Sioux River. Slopes are long and smooth and mostly nearly level, but some are gently sloping along drainageways. Small areas of steeper soils are on terrace fronts and escarpments and on the sides of entrenched drainageways.

This association makes up about 2 percent of the county. It is about 45 percent Graceville soils, 35 percent Dempster soils, and 20 percent minor soils.

Graceville soils are deep over sand and gravel. They have plane to slightly concave, nearly level slopes and are moderately well drained. Their surface layer is dark-gray silty clay loam. The subsoil is silty clay loam that is dark grayish brown in the upper part and yellowish brown in the lower part.

Dempster soils are moderately deep over sand and gravel. They are nearly level to gently sloping and are well drained. Their surface layer is dark-gray silt loam. The subsoil is dark grayish-brown and brown silt loam in the upper and middle parts and brown loam in the lower part.

Minor in this association are Alcester soils on fans between terraces and adjacent uplands, Delmont soils on convex rises, and Talmo soils on terrace escarpments and the sides of entrenched drainageways.

The Graceville soils in this association have only slight limitations for crops. The Dempster soils have moderate available water capacity and are somewhat droughty. Conservation of moisture is the main concern of management. Control of erosion is a concern of management on gently sloping soils.

Nearly all of this association is cultivated. Corn, oats, soybeans, and alfalfa are the main crops. The soils have good potential for irrigation, and in most areas adequate water can be obtained from shallow wells. The underlying sand and gravel are a source of construction material.

10. Delmont-Graceville-Talmo association

Moderately well drained to excessively drained, nearly level to undulating, loamy and silty soils that are deep to very shallow over sand and gravel

This soil association consists of convex rises and slightly depressed swales on terraces along Long Creek. Slopes commonly are short and irregular and are mostly gently undulating to undulating. Some slopes are nearly level.

This association makes up about 2 percent of the county. It is about 40 percent Delmont soils, 25 percent Graceville soils, 15 percent Talmo soils, and 20 percent minor soils.

Delmont soils are shallow over sand and gravel. They are on convex rises and are well drained. They have a surface layer and subsoil of dark grayish-brown loam.

Graceville soils are deep over sand and gravel. They are in swales and slight depressions and are moderately well drained. Their surface layer is dark-gray silty clay loam. The subsoil is silty clay loam that is dark grayish brown in the upper part and yellowish brown in the lower part.

Talmo soils are very shallow over sand and gravel and are excessively drained. They are on the steeper parts of the landscape on the tops and upper sides of ridges and knolls. They have a thin surface layer of very dark gray, calcareous gravelly loam. Below this is a thin layer of dark grayish-brown, calcareous gravelly loam. Sand and gravel are at a depth of 8 inches.

Minor in this association are Dempster soils intermingled with Delmont soils, Lamo and Salmo soils on bottom lands, and Wentworth soils in areas near Graceville soils.

The Graceville soils in this association have only slight limitations for crops. The dominant Delmont soils have low available water capacity and are

droughty. The Talmo soils have low or very low available water capacity and low fertility. They are not suited to cultivation. Conservation of moisture and control of erosion and soil blowing are the main concerns of management.

Most of this association is cultivated. Except for the Graceville soils, the soils of this association are better suited to small grain and grasses than to corn or alfalfa. The underlying sand and gravel are a possible source of construction material.

Descriptions of the Soils

This section describes the soil series and mapping units in Lincoln County. Each series is described in detail, and then, briefly, each mapping unit in that series. Unless specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Marsh, for example, does not belong to a soil series but, nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit, pasture group, and windbreak group in which the mapping unit has been placed. The page for the description of each capability unit, pasture group, and windbreak group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The names of some soils are unlike those that appear in the previously published survey of Minnehaha County. This is the result of changes in concepts in the application of the soil classification system.

The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the "Glossary," and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*).[1]

[1]Italic numbers in parentheses refer to Literature Cited, p. 78.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Alcester silty clay loam, 0 to 2 percent slopes	3,900	1.1
Alcester silty clay loam, 2 to 6 percent slopes	3,500	1.0
Alcester silty clay loam, channeled	3,000	.8
Alcester and Lamo silty clay loams	3,200	.9
Bon soils, frequently flooded	2,300	.6
Chancellor-Tetonka silty clay loams	25,500	6.9
Chancellor-Viborg silty clay loams	13,200	3.6
Chancellor-Wakonda-Tetonka complex	17,400	4.7
Clamo silty clay loam	2,300	.6
Crofton-Nora silt loams, 9 to 17 percent slopes, eroded	9,200	2.5
Davis loam	1,500	.4
Delmont loam, 0 to 2 percent slopes	456	.1
Delmont loam, 2 to 6 percent slopes	1,050	.3
Delmont-Graceville complex, 2 to 6 percent slopes	2,150	.6
Delmont and Talmo soils, 2 to 9 percent slopes	1,500	.4
Dempster silt loam, 0 to 2 percent slopes	2,000	.5
Dempster silt loam, 2 to 6 percent slopes	830	.2
Egan silty clay loam, 3 to 6 percent slopes	29,500	8.0
Egan-Chancellor silty clay loams, 2 to 4 percent slopes	13,700	3.7
Egan-Shindler complex, 2 to 6 percent slopes	11,600	3.2
Egan-Shindler complex, 6 to 9 percent slopes	7,800	2.1
Egan-Worthing complex, 2 to 6 percent slopes	4,400	1.2
Graceville silty clay loam	4,250	1.2
Huntimer silty clay loam, 0 to 2 percent slopes	3,050	.8
Lamo silty clay loam	7,300	2.0
Luton silty clay	480	.1
Marsh	1,100	.3
Moody silty clay loam, 0 to 2 percent slopes	1,450	.4
Moody silty clay loam, 2 to 6 percent slopes	12,200	3.3
Moody-Nora silty clay loams, 2 to 6 percent slopes	2,450	.7
Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded	18,400	5.0
Salmo silty clay loam, very wet	2,050	.6
Shindler clay loam, 9 to 15 percent slopes	700	.2
Shindler clay loam, 25 to 40 percent slopes	1,900	.5
Shindler-Egan complex, 9 to 15 percent slopes, eroded	3,100	.8
Shindler-Renner complex, 15 to 40 percent slopes	2,300	.6
Shindler and Talmo soils, 6 to 30 percent slopes	530	.1
Steinauer-Shindler clay loams, 24 to 40 percent slopes	2,900	.8
Tetonka silty clay loam	5,100	1.4
Thurman fine sandy loam, 2 to 6 percent slopes	1,350	.4
Thurman fine sandy loam, 6 to 9 percent slopes	219	.1
Wentworth silty clay loam, 0 to 2 percent slopes	20,800	5.6
Wentworth-Chancellor silty clay loams, 0 to 2 percent slopes	106,300	28.9
Worthing silty clay	8,600	2.3
Water—Areas less than 40 acres in size	1,200	.3
Water—Areas more than 40 acres in size	175	([1])
Miscellaneous	750	.2
Total	368,640	100.0

[1] Less than 0.05 percent.

Alcester Series

The Alcester series consists of deep, moderately well drained, nearly level to gently sloping, silty soils on bottom lands and fans along streams and drainageways. These soils formed in alluvium that washed from adjacent uplands. The native vegetation was mainly tall grasses.

In a representative profile the surface layer is dark-gray silty clay loam about 18 inches thick. The subsoil is dark grayish-brown silty clay loam about 24 inches thick. It is slightly hard when dry and friable when moist. The underlying material is grayish-brown and light yellowish-brown, calcareous silty clay loam.

Organic-matter content and fertility are high. Permeability is moderate, and available water capacity is high. Runoff is slow or medium. Most areas receive runoff from adjacent soils.

Most areas are cultivated. The soils are well suited to all the crops grown in the county. A few areas are in native grasses and are used for pasture or hay.

Representative profile of Alcester silty clay loam, 0 to 2 percent slopes, in a cultivated area, 390 feet north and 1,150 feet east of the southwest corner of sec. 11, T. 96 N., R. 48 W.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam that crushes to dark grayish brown (10YR 4/2), black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, fine, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

A12—8 to 18 inches, dark-gray (10YR 4/1) silty clay loam that crushes to dark grayish brown (10YR 4/2), black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, medium, subangular blocky structure; slightly hard, friable; few worm casts; neutral; gradual, wavy boundary.

B2—18 to 32 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist, crushes to very dark grayish brown (10YR 3/2); weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky; slightly hard, friable; few wormcasts; neutral; gradual, wavy boundary.

B3—32 to 42 inches, dark grayish-brown (10YR 4/2) silty clay loam that crushes to grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2) when moist, crushes to dark grayish brown (10YR 4/2); weak, coarse, prismatic structure parting to weak, medium and fine, subangular blocky; slightly hard, friable; few wormcasts; neutral; gradual, wavy boundary.

C1ca—42 to 52 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse and medium, subangular blocky structure; hard, firm, slightly sticky; common fine segregations of lime; slight effervescence; mildly alkaline; gradual, wavy boundary.

C2ca—52 to 60 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) when moist; common, fine, faint mottles of light olive gray and yellowish brown when moist; weak, coarse, subangular blocky structure; hard, firm, sticky; common fine and medium segregations of lime; slight effervescence; moderately alkaline.

Depth to lime ranges from 36 to 60 inches. The solum is silty clay loam or silt loam that is 24 to 31 percent clay. The A horizon ranges from very dark gray to dark grayish brown and from 14 to 20 inches in thickness. In places there is a B1 horizon. The B2 horizon ranges from very dark gray to grayish brown and from 8 to 14 inches in thickness. The B3 horizon ranges from very dark gray to light olive brown in hue of 10YR or 2.5Y and from 6 to 10 inches in thickness. The C horizon commonly has few or common segregations of lime, but in places there are no free carbonates above a depth of 60 inches. The C horizon generally is silty clay loam or silt loam, but in some places it is clay loam or loam below a depth of 40 inches.

Alcester soils formed in alluvium, as did Bon, Davis, and Lamo soils. They are near Egan, Moody, and Nora soils. They contain more silt and less sand than Bon and Davis soils. They are better drained and less calcareous than Lamo soils. They have a thicker A horizon than Egan, Moody, and Nora soils.

Alcester silty clay loam, 0 to 2 percent slopes (AcA).—This nearly level soil is on bottom lands along streams and drainageways. Areas are mostly less than 80 acres in size, but a few are as large as 340 acres. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Lamo and Moody soils. Lamo soils are adjacent to stream channels. Moody soils are on the edges of some areas.

Runoff is slow. This soil receives runoff from adjacent soils. In most years the additional moisture is beneficial, but silt and debris cover some areas after intense rain. Limitations to use for crops are slight. Maintaining tilth and fertility is the main concern of management.

Most areas are cultivated. Corn, soybeans, alfalfa, and oats are the main crops. Capability unit I–1; pasture group K; windbreak group 1.

Alcester silty clay loam, 2 to 6 percent slopes (AcB).—This gently sloping soil is along drainageways. Areas are long and narrow and are less than 40 acres in size. The soil has a profile similar to the one described as representative of the series, but the depth to lime is slightly less.

Included with this soil in mapping are small areas of Moody soils, which commonly are on the higher lying edges of the areas of this soil.

Runoff is medium, and erosion is a hazard. The drainageways are subject to gullying. Controlling erosion is the main concern of management.

Most areas are cultivated. The soil is well suited to all the crops commonly grown in the county. Capability unit IIe–1; pasture group K; windbreak group 1.

Alcester silty clay loam, channeled (0 to 2 percent slopes) (Af).—This nearly level soil is in areas that are broken into small tracts by deep, meandering stream channels. Areas are long and narrow and are mostly less than 100 acres in size. In places the surface layer is covered with recently deposited sediment of grayish-brown, calcareous silt loam.

Included with this soil in mapping are small areas of Lamo soils adjacent to the stream channels. These included soils make up about 20 percent of the mapped areas.

Runoff is slow, and the soil is subject to flooding. Most of the areas cannot be crossed by farm machinery. Wetness and erosion of the channels are the main concerns of management.

Many areas are better suited to pasture than to most other uses because of the deep channels. Parts of some areas adjacent to other soils are cultivated as part of a larger field. Capability unit VIw–1; pasture group K; windbreak group 10.

Alcester and Lamo silty clay loams (0 to 2 percent

slopes) (Ah).—These nearly level soils are on bottom lands. Areas are broad and are as much as 1,600 acres in size. Some areas are mostly Alcester soil, some are mostly Lamo soil, and others contain both soils in proportions that differ from one area to another. In areas that contain both soils, the Alcester soil is in the higher areas and the Lamo soil is in the lower areas near the stream channel. In places the Alcester soil has a thin overwash of grayish-brown, calcareous silt loam.

Included with these soils in mapping are areas of a soil that is similar to this Alcester soil but has a more clayey subsoil. This included soil makes up 10 to 20 percent of the mapped areas.

Runoff is slow. Some areas are subject to stream flooding, and most receive runoff from adjacent uplands. This additional moisture is usually beneficial to the Alcester soil, but it causes the Lamo soil to remain wet for longer periods. The Alcester soil has only slight limitations to use for crops. Reducing wetness in the Lamo soil is the main concern of management.

All the acreage is cultivated. The soils are well suited to all crops grown in the county. Alcester soil in capability unit I–1, pasture group K, and windbreak group 1; Lamo soil in capability unit IIw–3 if drained and IVw–2 if not drained, pasture group A if drained and B if not drained, and windbreak group 2.

Bon Series

The Bon series consists of deep, moderately well drained, nearly level, loamy soils on bottom lands. These soils formed in alluvium. The native vegetation was mainly tall grasses, but narrow stringers of trees and shrubs were along some of the stream channels.

In a representative profile the upper part of the surface layer is about 16 inches of dark-gray loam. The lower part of the surface layer is about 8 inches of dark grayish-brown, calcareous loam and 12 inches of dark grayish-brown fine sandy loam. The underlying material is dark grayish-brown, calcareous loam and grayish-brown, calcareous fine sandy loam.

Organic-matter content and fertility are high. Permeability is moderate, and available water capacity is high. Runoff is slow. Flooding is frequent, and a seasonal high water table is within a depth of 5 feet early in the growing season.

The larger areas are cultivated. Corn, soybeans, and sorghum are the main crops. Some of the narrow areas are in native vegetation and are used for pasture and wildlife habitat.

Representative profile of Bon loam in a cultivated area of Bon soils, frequently flooded, 1,340 feet west and 105 feet north of the southeast corner of sec. 17, T. 98 N., R. 48 W.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) loam that crushes to dark grayish brown (10YR 4/2), black (10YR 2/1) when moist; weak, fine, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

A12—8 to 16 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, coarse, subangular blocky structure parting to weak, fine, granular; slightly hard, friable; strong effervescence; moderately alkaline; gradual, wavy boundary.

A13—16 to 24 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, coarse and medium, subangular blocky structure; slightly hard, friable; strong effervescence; moderately alkaline; gradual, wavy boundary.

A14—24 to 36 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, very coarse and coarse, subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; gradual, wavy boundary.

C1—36 to 45 inches, dark grayish-brown (10YR 4/2) loam stratified with thin lenses of fine sandy loam and loamy fine sand, very dark brown (10YR 2/2) when moist, crushes to very dark grayish brown (10YR 3/2); weak, very coarse and coarse, subangular blocky structure; slightly hard, friable; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—45 to 60 inches, grayish-brown (10YR 5/2) fine sandy loam stratified with thin lenses of loamy fine sand, very dark grayish brown (10YR 3/2) when moist, crushes to dark grayish brown (10YR 4/2); massive; slightly hard, friable; strong effervescence; moderately alkaline.

Depth to free carbonates commonly ranges from 6 to 16 inches, but in some places the soil is calcareous at the surface. The A horizon ranges from very dark gray to dark grayish brown. It commonly is loam or silt loam, but in places it contains layers of fine sandy loam. The A horizon ranges from 20 to 40 inches in thickness. A buried A horizon is common in the C horizon.

Many areas of Bon soils in Lincoln County are flooded more frequently than is typical for the Bon series. These Bon soils, therefore, are not so well suited to crops as the Bon soils in other counties.

Bon soils are on bottom lands, as are Alcester, Clamo, and Lamo soils. They are near Davis soils. They contain less silt and more sand than Alcester soils. They are better drained than Clamo and Lamo soils. They are more shallow to lime than Davis soils.

Bon soils, frequently flooded (0 to 2 percent slopes) (Bo).—These nearly level soils are on bottom lands. Old stream channels, meander scars, and flood channels are common, and there are narrow, low ridges in some areas. The surface layer commonly is loam, but in some areas it is silt loam or fine sandy loam and in others it is all of these textures.

Included with these soils in mapping are small areas of Lamo soils in swales and old channels. Also included are areas of a soil that has a surface layer of fine sandy loam and underlying material of loamy fine sand or fine sand. This sandy soil is on narrow, dunelike ridges and makes up as much as 20 or 30 percent of some mapped areas.

Runoff is slow. Except for a few small areas, these soils are flooded frequently. Flooding commonly occurs during spring, but the most severe crop damage is caused by flooding from summer storms. Wetness caused by flooding is the main concern of management, but controlling soil blowing is important in areas that include low ridges of sandy soils.

These soils are used equally for pasture and crops. Late-planted crops, such as corn or sorghum, are better suited than spring-sown small grain. Capability unit IIIw–4; pasture group K; windbreak group 1.

Chancellor Series

The Chancellor series consists of deep, somewhat poorly drained, nearly level to gently sloping, silty soils that have a clayey subsoil. These soils are on uplands in swales and in depressions along drainageways. They formed in alluvium that washed from surround-

ing soils. The native vegetation was mainly tall grasses.

In a representative profile the surface layer is dark-gray silty clay loam about 18 inches thick. The subsoil is about 18 inches of silty clay that is dark gray in the upper part and olive gray in the lower part. It is extremely hard when dry, firm when moist, and sticky and plastic when wet. The underlying material is calcareous silty clay loam that is light olive gray in the upper part and gray in the lower part.

Organic-matter content and fertility are high. Permeability is slow, and available water capacity is high. Runoff is slow. Most areas receive runoff from adjacent soils. A seasonal high water table is within a depth of 5 feet early in the growing season.

Most areas are cultivated. The soils are well suited to all crops commonly grown in the county. A few areas are in native vegetation and are used for pasture or hay.

Representative profile of Chancellor silty clay loam in a cultivated area of Chancellor-Tetonka silty clay loams, 180 feet east and 342 feet south of the northwest corner of sec. 33, T. 99 N., R. 49 W.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt, smooth boundary.

A12—8 to 18 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure parting to weak, fine, granular; slightly hard, friable, sticky and slightly plastic; neutral; gradual, smooth boundary.

B21t—18 to 28 inches, dark-gray (5Y 4/1) silty clay, black (5Y 2/1) when moist; few, fine, distinct mottles of light olive brown (2.5Y 5/4) when moist; weak, medium, prismatic structure parting to moderate, medium and fine, blocky; extremely hard, firm, sticky and plastic; thin patchy clay films on vertical faces of peds; mildly alkaline; gradual, wavy boundary.

B22tg—28 to 36 inches, olive-gray (5Y 4/2) silty clay, dark olive gray (5Y 3/2) when moist; few tongues of black (5Y 2/1) when moist; common, fine, faint mottles of olive gray and few, fine, distinct mottles of strong brown (7.5YR 5/6) when moist; weak, medium, prismatic structure parting to moderate, medium and fine, blocky; extremely hard, firm, sticky and plastic; thin patchy clay films on vertical faces of peds; few fine threads of salt; few fine iron-manganese concretions; mildly alkaline; gradual, wavy boundary.

C1gca—36 to 43 inches, light olive-gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) when moist; common, fine, distinct mottles of light olive brown (2.5Y 5/6) and strong brown (7.5YR 5/6) and few, fine, distinct mottles of very dark brown (10YR 2/2) when moist; massive; hard, firm, sticky and plastic; few fine nests of gypsum; few fine iron-manganese concretions; few fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2gcacs—43 to 53 inches, gray (5Y 6/1) silty clay loam, olive gray (5Y 5/2) when moist; few, fine, distinct mottles of light olive brown (2.5Y 5/6) and strong brown (7.5YR 5/6) and common, fine, distinct mottles of very dark brown (10YR 2/2) when moist; massive; hard, firm, sticky and plastic; common medium nests of gypsum; few fine iron-manganese concretions; few fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C3gcs—53 to 60 inches, gray (5Y 6/1) silty clay loam, olive gray (5Y 5/2) when moist; common, medium, distinct mottles of light olive brown (2.5Y 5/6) and strong brown (7.5YR 5/6) and few, fine, distinct mottles of very dark brown (10YR 2/2) when moist; massive; hard, firm, sticky and plastic; many medium nests of gypsum; common fine iron-manganese concretions; few medium segregations of lime; strong effervescence; moderately alkaline.

Depth to free carbonates ranges from 28 to 44 inches. The A horizon is very dark gray or dark gray in hue of 10YR or 2.5Y. It is silty clay loam or silty clay that ranges from 12 to 20 inches in thickness. The B2t horizon ranges from dark gray to light olive gray in hue of 5Y or 2.5Y. It is 38 to 52 percent clay and ranges from 16 to 24 inches in thickness. Mottles in the B and C horizons range from few to many. Segregations of lime are few or common in the C horizon.

Chancellor soils are mapped with Tetonka, Viborg, and Wakonda soils. They have a profile similar to those of Clamo and Worthing soils. They are better drained than Clamo, Tetonka, and Worthing soils. They have a more clayey B horizon than Viborg and Wakonda soils.

Chancellor-Tetonka silty clay loams (0 to 2 percent slopes) (Ca).—The soils in this complex are in upland swales that contain many small depressions. This complex is about 65 percent Chancellor soil, 25 percent Tetonka soil, and 10 percent other soil. Areas are mostly long and narrow and are less than 150 acres in size.

The Chancellor soil is in the swales that connect the depressions. The Tetonka soil is in the depressions. The Chancellor soil has the profile described as representative of the Chancellor series.

Included with these soils in mapping are small areas of Viborg, Wakonda, and Worthing soils. Viborg soils are on the edges of the areas. Wakonda soils form a narrow rim around some of the depressions and on the edge of some of the swales. Worthing soils are in some of the depressions. Also included are some areas of a soil that is similar to the Tetonka soil but has a thicker surface layer.

Runoff is slow, and water ponds on the Tetonka soil. The soils lose their tilth and compact if they are farmed when wet. Controlling wetness, which is caused by a high water table and ponded water, and maintaining tilth are the main concerns of management.

Most areas of these soils are cultivated. If the soils are adequately drained, they are suited to all crops grown in the county. Unless the Tetonka soil is adequately drained, it is better suited to pasture or late-planted crops than to other uses. Capability unit IIw-1; Chancellor soil in pasture group A and windbreak group 2; Tetonka soil in pasture group A if drained and B if not drained and in windbreak group 10.

Chancellor-Viborg silty clay loams (0 to 2 percent slopes) (Cd).—The soils in this complex are in swales and slight depressions in the uplands. This complex is about 55 percent Chancellor soil, 35 percent Viborg soil, and 10 percent other soil. Areas commonly are long and narrow and range from 5 to 100 acres in size.

The Chancellor soil is in the low parts of the areas. The Viborg soil is on the high edges of the areas. The Viborg soil has the profile described as representative of the Viborg series.

Included with these soils in mapping are small areas of Tetonka, Wakonda, and Wentworth soils. Tetonka soils are in small depressions. Wakonda soils are on the rims of the depressions and some of the swales. Wentworth soils are on slight rises on the edges of the areas.

Runoff is slow. These soils receive runoff from adjacent sloping soils. This additional moisture generally is beneficial, but during wet years the soils dry out slowly. Tilth deteriorates if the soils are farmed when wet. Controlling the occasional wetness and maintaining tilth are the main concerns of management.

Almost all areas of these soils are cultivated. The soils are suited to all crops commonly grown in the county. Corn, soybeans, sorghum, or other late-planted crops are better suited in wet years. Capability unit IIw–1; Chancellor soil in pasture group A and windbreak group 2; Viborg soil in pasture group K and windbreak group 1.

Chancellor-Wakonda-Tetonka complex (0 to 2 percent slopes) (Ch).—The soils in this complex are in broad swales that contain numerous circular depressions. This complex is about 35 percent Chancellor soil, 35 percent Wakonda soil, 20 percent Tetonka soil, and 10 percent other soil. Areas are as much as 500 acres in size.

The Chancellor soil is in the lower part of the swales between the depressions. The Wakonda soil is in bands that surround the Chancellor soil and also on narrow rims around the depressions. The Tetonka soil is in the depressions. The Chancellor and Tetonka soils have a surface layer of silty clay loam. The Wakonda soil has the profile described as representative of the Wakonda series. Its surface layer is silt loam.

Included with these soils in mapping are small areas of Viborg and Wentworth soils. Viborg soils are on the edges of areas where Wentworth soils are on the highest positions. Also included are some areas of a soil that is similar to the Wakonda soil but has loam texture and some areas of a soil that is similar to the Wentworth soil but has lime and salts at a depth of 12 to 18 inches.

Runoff is slow, and water ponds on the Tetonka soil. The soils lose their tilth if they are farmed when wet. Controlling wetness on the Tetonka soil and maintaining tilth are the main concerns of management. Soil blowing is a hazard on the calcareous Wakonda soil.

Most areas of these soils are cultivated. If the soils are adequately drained, they are suited to all crops commonly grown in the county. Corn, soybeans, sorghum, or other late-planted crops are better suited than other crops. Undrained Tetonka soils are better suited to pasture or late-planted crops than to others. Capability unit IIw–1; Chancellor soil in pasture group A and windbreak group 2; Wakonda soil in pasture group F and windbreak group 1; Tetonka soil in pasture group A if drained and B if not drained and in windbreak group 10.

Clamo Series

The Clamo series consists of deep, poorly drained, level, silty soils that have a clayey subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mainly tall grasses and stringers of trees along stream channels.

In a representative profile the surface layer is very dark gray silty clay loam about 8 inches thick. The subsoil, about 16 inches thick, is dark-gray silty clay loam in the upper part and dark-gray, calcareous silty clay in the lower part. The upper part is hard when dry, firm when moist, and sticky and plastic when wet. The underlying material is calcareous silty clay that is gray in the upper part and olive gray in the lower part.

Organic-matter content and fertility are high. Permeability is slow, and available water capacity is moderate or high. Runoff is slow. These soils are flooded occasionally. The water table fluctuates between depths of 2 and 8 feet.

Most areas are cultivated. Corn, soybeans, oats, and alfalfa are the main crops. A few areas are in native grass and are used for pasture or hay.

Representative profile of Clamo silty clay loam, in a cultivated area, 1,325 feet north and 252 feet west of the southeast corner of sec. 26, T. 98 N., R. 49 W.:

Ap—0 to 8 inches, very dark gray (5Y 3/1) silty clay loam, black (5Y 2/1) when moist; cloddy; hard, friable, sticky and slightly plastic; neutral; abrupt, smooth boundary.

B2g—8 to 16 inches, dark-gray (5Y 4/1) silty clay loam, black (5Y 2/1) when moist; weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky; hard, firm, sticky and plastic; neutral; clear, wavy boundary.

B3gca—16 to 24 inches, dark-gray (5Y 4/1) silty clay, dark olive gray (5Y 3/2) when moist; few pore coatings and tongues of black when moist; few, fine, distinct mottles of olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/6) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; very hard, firm, sticky and plastic; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C1gca—24 to 38 inches, gray (5Y 5/1) silty clay, dark olive gray (5Y 3/2) when moist; few, fine, faint mottles of dark gray and few, fine, distinct mottles of light olive brown (2.5Y 5/6) when moist; weak, coarse, subangular blocky structure; very hard, very firm, sticky and plastic; few fine iron concretions; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2gcacs—38 to 45 inches, gray (5Y 5/1) silty clay, dark olive gray (5Y 3/2) when moist; common, fine, faint mottles of gray and common, fine, distinct mottles of light olive brown (2.5Y 5/6) when moist; massive; very hard, firm, sticky and plastic; few fine iron concretions; common medium segregations of gypsum; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C3g—45 to 60 inches, olive-gray (5Y 5/2) silty clay, dark olive gray (5Y 3/2) when moist; common, fine, faint mottles of gray and olive and common, fine, distinct mottles of light olive brown (2.5Y 5/6) and dark reddish brown (5YR 2/2) when moist; massive; very hard, firm, sticky and plastic; common fine iron concretions; few fine and medium segregations of lime; strong effervescence; moderately alkaline.

Depth to lime ranges from 14 to 30 inches. The A horizon is very dark gray or dark gray in hue of 5Y or 2.5Y. It is silty clay loam or silty clay that ranges from 5 to 14 inches in thickness. The B2g horizon ranges from very dark gray to gray in hue of 5Y or 2.5Y. It is silty clay loam or silty clay. In places there is no B3gca horizon. Common or many segregations of lime and gypsum are in the B3gca and Cgca horizons. Thin strata of sand or silt and a buried A horizon are below a depth of 36 inches or more in places.

Clamo soils are on bottom lands, as are Luton, Lamo, and Salmo soils. They have a profile similar to that of Chancellor soils. They are more shallow to lime than Chancellor and Luton soils. They contain more clay than Lamo soils and less salts than Salmo soils.

Clamo silty clay loam (0 to 1 percent slopes) (Co).—

This level soil is on bottom lands along the larger streams. Areas are as much as 750 acres in size.

Included with this soil in mapping are small areas of Lamo soils along stream channels. Also included are some areas of a soil that is similar to this Clamo soil, but the depth to lime is more than 30 inches.

Runoff is slow. The soil is subject to flooding and has a high water table. If the soil is cultivated when wet, it compacts and is very hard and cloddy upon drying. During wet years, spring planting commonly is delayed. Controlling wetness and maintaining tilth are the main concerns of management.

Most areas are cultivated. Corn, soybeans, oats, and alfalfa are the main crops. Pasture plants and late-planted crops are better suited than others if drainage is not adequate. Capability unit IIw–3 if drained and IVw–2 if not drained; pasture group A if drained and B if not drained; windbreak group 2.

Crofton Series

The Crofton series consists of deep, well-drained, strongly sloping, silty soils on uplands. These soils formed in loess. The native vegetation was mainly mid and tall grasses.

In a representative profile the surface layer is grayish-brown, calcareous silt loam about 6 inches thick. The underlying material is calcareous silt loam that is pale brown in the upper part and light yellowish brown in the lower part.

Organic-matter content and fertility are low. Permeability is moderate, and available water capacity is high. Runoff is rapid.

Many areas are or have been cultivated, but the soils are better suited to pasture or hay. Some areas are in native grass and are used for pasture.

Representative profile of Crofton silt loam in a cultivated area of Crofton-Nora silt loams, 9 to 17 percent slopes, eroded, 2,570 feet south and 87 feet west of the northeast corner of sec. 25, T. 96 N., R. 50 W.:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft, friable; few fine and medium concretions of lime; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C1—6 to 19 inches, pale-brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) when moist; few, fine, distinct mottles of gray (5Y 5/1) when moist; weak, coarse, prismatic structure; soft, friable; common fine and medium concretions of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—19 to 60 inches, light yellowish-brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/3) when moist; common, fine, distinct mottles of gray (5Y 5/1) and olive yellow (2.5Y 6/6) and few, fine, rusty-colored mottles when moist; weak, coarse, subangular blocky structure; soft, friable; few fine and medium concretions of lime; strong effervescence; moderately alkaline.

Depth to free carbonates ranges to as much as 8 inches in undisturbed areas of native grass, but in cultivated areas the soil commonly is calcareous at the surface. Few to many fine and medium concretions of lime are on the surface in cultivated areas. The A horizon ranges from grayish brown to pale brown. It is neutral to moderately alkaline and ranges from 3 to 6 inches in thickness. In some places there is a transitional AC horizon. The C horizon ranges from brown to pale yellow in hue of 10YR or 2.5Y. It has few to many concretions of lime and is mildly alkaline or moderately alkaline.

Crofton soils are mapped with Nora soils and are near Moody soils. Their position in the landscape is similar to that of Steinauer soils. They do not have a B horizon and are more shallow to lime than Nora and Moody soils. They are more silty than Steinauer soils.

Crofton-Nora silt loams, 9 to 17 percent slopes, eroded (CpD2).—The soils in this complex commonly are on the sides of the larger, more deeply entrenched drainageways in the uplands. This complex is about 45 percent Crofton soil, 35 percent Nora soil, and 20 percent other soil.

The Crofton soil has steeper, more convex slopes and is on the higher parts of the landscape. It has a profile similar to the one described as representative of the Crofton series, but the surface layer is pale brown in the more severely eroded areas. The Nora soil has long, smooth slopes and commonly is below the Crofton soil. It has a profile similar to the one described as representative of the Nora series, but the surface layer is silt loam and the soil is shallower to lime. Also, in eroded spots the surface layer is grayish brown.

Included with these soils in mapping are small areas of Alcester and Moody soils. Alcester soils are on bottom lands and fans along drainageways. Moody soils are above Alcester soils.

Runoff is rapid. Cultivated and formerly cultivated areas are moderately eroded to severely eroded. Controlling erosion and soil blowing, conserving moisture, and improving fertility and the content of organic matter are the main concerns of management.

Many areas of these soils are cultivated, but the soils are better suited to pasture than to other uses. Capability unit VIe–3; windbreak group 10; Crofton soil in pasture group G, Nora soil in pasture group F.

Davis Series

The Davis series consists of deep, moderately well drained, nearly level soils on low terraces along streams. These soils formed in alluvium. The native vegetation was mainly mid and tall grasses.

In a representative profile the surface layer is dark-gray loam about 10 inches thick. The subsoil is dark grayish-brown loam about 33 inches thick. It is slightly hard when dry and friable when moist. The underlying material is brown loam in the upper part and grayish-brown, calcareous fine sandy loam in the lower part.

Organic-matter content and fertility are high. Permeability is moderate, and available water capacity is high. Runoff is slow. Flooding is a hazard early in spring during snowmelt.

Most areas are cultivated. Corn, soybeans, oats, alfalfa, and sorghum are the main crops. A few areas are in native grasses and are used for pasture or hay.

Representative profile of Davis loam, in a cultivated area, 800 feet north and 1,225 feet east of the center of sec. 23, T. 97 N., R. 48 W.:

Ap—0 to 10 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure parting to weak, fine, granular; slightly hard, friable; slightly acid; abrupt, smooth boundary.

B1—10 to 17 inches, dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, coarse, pris-

matic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable; slightly acid; gradual, wavy boundary.

B21—17 to 28 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist, crushes to very dark grayish brown (10YR 3/2); weak, coarse and medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; neutral; gradual, wavy boundary.

B22—28 to 37 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist, crushes to very dark grayish brown (10YR 3/2); weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; neutral; gradual, wavy boundary.

B3—37 to 43 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable; neutral; gradual, wavy boundary.

C1—43 to 55 inches, brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) when moist, crushes to dark brown (10YR 3/3); weak, coarse, subangular blocky structure; slightly hard, friable; neutral; gradual, wavy boundary.

C2ca—55 to 60 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard, friable; many fine segregations of lime; strong effervescence; moderately alkaline.

Depth to lime ranges from 40 to 60 inches. The A horizon ranges from very dark gray to dark grayish brown. It is loam or silt loam and ranges from 8 to 18 inches in thickness. The B2 horizon ranges from very dark gray to grayish brown. It is loam or silt loam and ranges from 13 to 26 inches in thickness. In places there is no B3 horizon. The C horizon ranges from fine sandy loam to clay loam, but in some places layers of fine sand are at a depth of 40 inches or more.

Davis soils are near Alcester and Bon soils. They contain less silt and more sand than Alcester soils. They have a B horizon, which Bon soils lack, and they are deeper over lime.

Davis loam (0 to 2 percent slopes) (Da).—This soil is on low terraces along streams. Areas are long and narrow and are as much as 180 acres in size. The surface layer is fine sandy loam in a few areas, but the profile otherwise is similar to that described as representative of the series.

The soil is easy to work. Fertility is high. Runoff is slow. Flooding is a slight hazard early in spring. Other limitations to use for crops are only slight.

Most areas are cultivated. The soil is well suited to all crops commonly grown in the county. In most areas an adequate supply of water for irrigation can be obtained from shallow wells. Capability unit I–1; pasture group K; windbreak group 1.

Delmont Series

The Delmont series consists of somewhat excessively drained, nearly level to undulating, loamy soils that are shallow over sand and gravel (fig. 5). These soils are on uplands and terraces. They formed in loamy material over outwash sand and gravel. The native vegetation was mainly mid and short grasses.

In a representative profile the surface layer is dark grayish-brown loam about 6 inches thick. The subsoil is dark grayish-brown loam about 8 inches thick. The upper part is soft when dry and friable when moist.

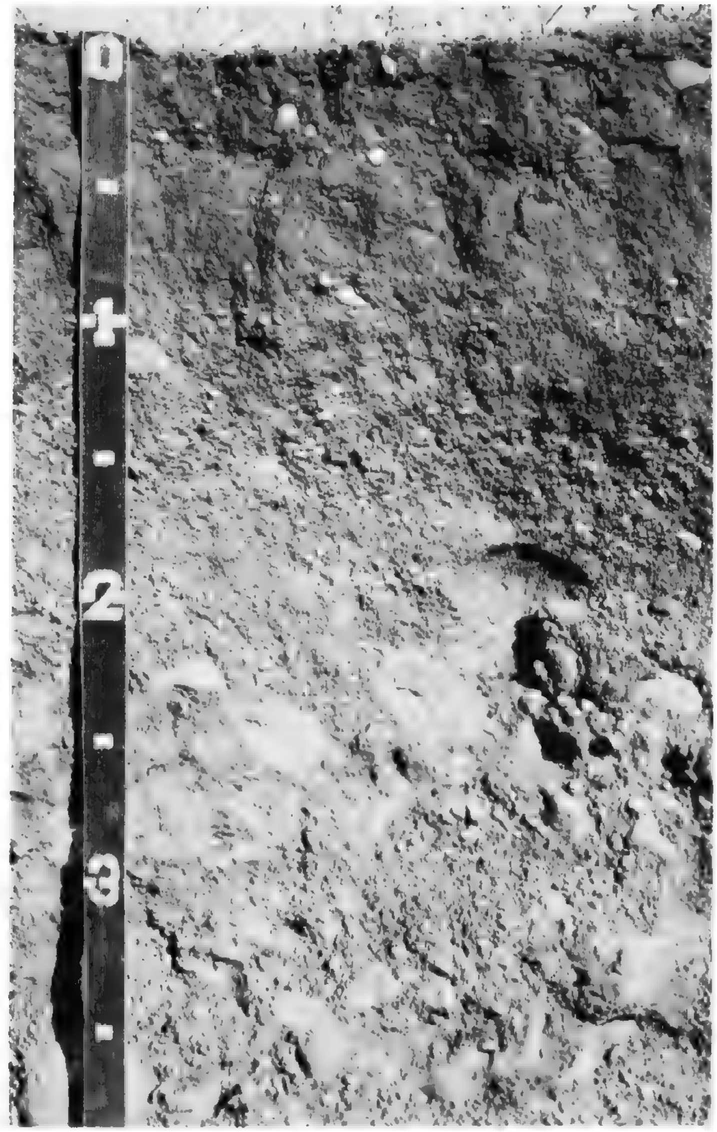

Figure 5.—**A profile of Delmont loam, 2 to 6 percent slopes. Sand and gravel are at a depth of about 14 inches.**

The underlying material to a depth of 25 inches is dark-brown medium and coarse sand mixed with gravel. Below a depth of 25 inches it is brown, calcareous sand and gravel.

Organic-matter content is moderate, and fertility is medium. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Available water capacity is low. Runoff is slow or medium.

Many areas are cultivated. Others are in native grass and are used for pasture. Some are a source of sand and gravel for construction purposes.

Representative profile of Delmont loam, 2 to 6 percent slopes, in a cultivated area, 1,320 feet south and 2,410 feet west of the northeast corner of sec. 24, T. 96 N., R. 48 W.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, medium, subangular blocky structure parting to weak, fine, granu-

lar; soft, friable; neutral; abrupt, smooth boundary.

B21—6 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark gray (10YR 3/1) when moist, crushes to very dark grayish brown (10YR 3/2); weak, coarse, prismatic structure parting to weak, medium and fine, subangular blocky; soft, friable; neutral; clear, wavy boundary.

B22—10 to 14 inches, dark grayish-brown (10YR 4/2) loam that crushes to dark brown (10YR 4/3), very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure parting to weak, medium and fine, subangular blocky; soft, very friable; neutral; clear, wavy boundary.

IIC1—14 to 25 inches, dark-brown (10YR 4/3) medium and coarse sand mixed with gravel, dark brown (10YR 3/3) when moist; single grained; loose; crusts of lime coat some pebbles; neutral; clear, wavy boundary.

IIC2ca—25 to 60 inches, brown (10YR 5/3) sand and gravel, dark brown (10YR 4/3) when moist; single grained; loose; slight effervescence; mildly alkaline.

Depth to the underlying sand and gravel ranges from 10 to 20 inches. The A horizon ranges from very dark gray to grayish brown. It is loam, silt loam, or very fine sandy loam and ranges from 5 to 9 inches in thickness. The B2 horizon ranges from very dark gray to dark grayish brown. In some places there is a thin B3 horizon of loam or sandy loam.

Delmont soils are mapped with Graceville and Talmo soils and are near Dempster soils. They contain less silt than Dempster and Graceville soils, and they are shallower over sand and gravel. Delmont soils are deeper over sand and gravel than Talmo soils.

Delmont loam, 0 to 2 percent slopes (DeA).—Areas of this nearly level soil are irregular in shape and range from 5 to 200 acres in size. The soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thicker.

Included with this soil in mapping are areas of Dempster soils in slight depressions. These included soils make up 10 to 20 percent of the mapped areas.

Runoff is slow. The soil is easy to work, but available water capacity is low and the soil is droughty. Conserving moisture is the main concern of management.

Most areas are cultivated. Early maturing crops, such as spring-sown small grain, are better suited than other crops. Capability unit IIIs–3; pasture group D; windbreak group 10.

Delmont loam, 2 to 6 percent slopes (DeB).—Areas are long and narrow and range from 5 to 60 acres in size. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Dempster and Talmo soils. Dempster soils are on the lower parts of the landscape. Talmo soils are on the higher parts, where slopes are short and convex.

Runoff is medium. Available water capacity is low, and the soil is droughty. Conserving moisture is the main concern of management. Water erosion and soil blowing are hazards.

Most of the acreage is cultivated. Early maturing crops, such as spring-sown small grain, are better suited than corn. Capability unit IVs–2; pasture group D; windbreak group 10.

Delmont-Graceville complex, 2 to 6 percent slopes (DgB).—The soils in this complex are on a series of convex ridges or knolls and in intervening swales. This complex is about 45 percent Delmont soil, 35 percent Graceville soil, and 20 percent other soil. Areas are irregular in shape and range from 10 to 120 acres in size.

The Delmont soil is on the ridges and knolls. It has a surface layer of loam. The Graceville soil is in the swales. Its surface layer is silty clay loam.

Included with these soils in mapping are areas of Talmo and Wentworth soils. Talmo soils are on some of the ridges. Wentworth soils are near the Graceville soil.

Runoff is medium on these soils. The Graceville soil has high available water capacity, and it receives runoff from adjacent soils. The Delmont soil is droughty, and conserving moisture and controlling water erosion and soil blowing are concerns of management. The Graceville soil has only slight limitations to use for crops.

Most areas of these soils are cultivated. The Delmont soil is better suited to small grain, soybeans, and grasses than to such deep-rooted crops as corn and alfalfa. Capability unit IVs–2; Delmont soil in pasture group D and windbreak group 10; Graceville soil in pasture group K and windbreak group 1.

Delmont and Talmo soils, 2 to 9 percent slopes (DkB).—These gently undulating to undulating soils are on terrace fronts along major streams. Areas are long and narrow and range from 5 to 65 acres in size. Some areas are mostly Delmont soil, some are mostly Talmo soil, and others contain both soils in proportions that differ from one area to another. Slopes of the Delmont soil are longer than those of the Talmo soil, which has steeper, more convex slopes.

The Delmont soil has a surface layer of loam. Talmo soil has a surface layer of gravelly loam. It has the profile described as representative of the Talmo series, but in cultivated areas erosion has exposed the sand and gravel.

Included with these soils in mapping are small areas of Dempster soils, which commonly occupy concave, low positions on the landscape.

Runoff is medium on the Delmont soil and slow on the Talmo soil. Available water capacity is low or very low, and the soils are droughty. Conserving moisture and controlling water erosion and soil blowing are the main concerns of management.

Some areas of the Delmont soil are cultivated, but areas that are mostly Talmo soil are in native grass and are used for pasture. Areas that contain both soils are better suited to pasture than to most other uses. Windbreak group 10; Delmont soil in capability unit IVs–2 and pasture group D; Talmo soil in capability unit VIs–3, not assigned to a pasture group.

Dempster Series

The Dempster series consists of well-drained, nearly level to gently sloping, silty soils that are moderately deep over sand and gravel (fig. 6). These soils are on terraces and uplands. They formed in silty alluvium underlain by outwash sand and gravel. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark-gray silt loam about 9 inches thick. The subsoil is about 23 inches thick. It is dark grayish-brown silt

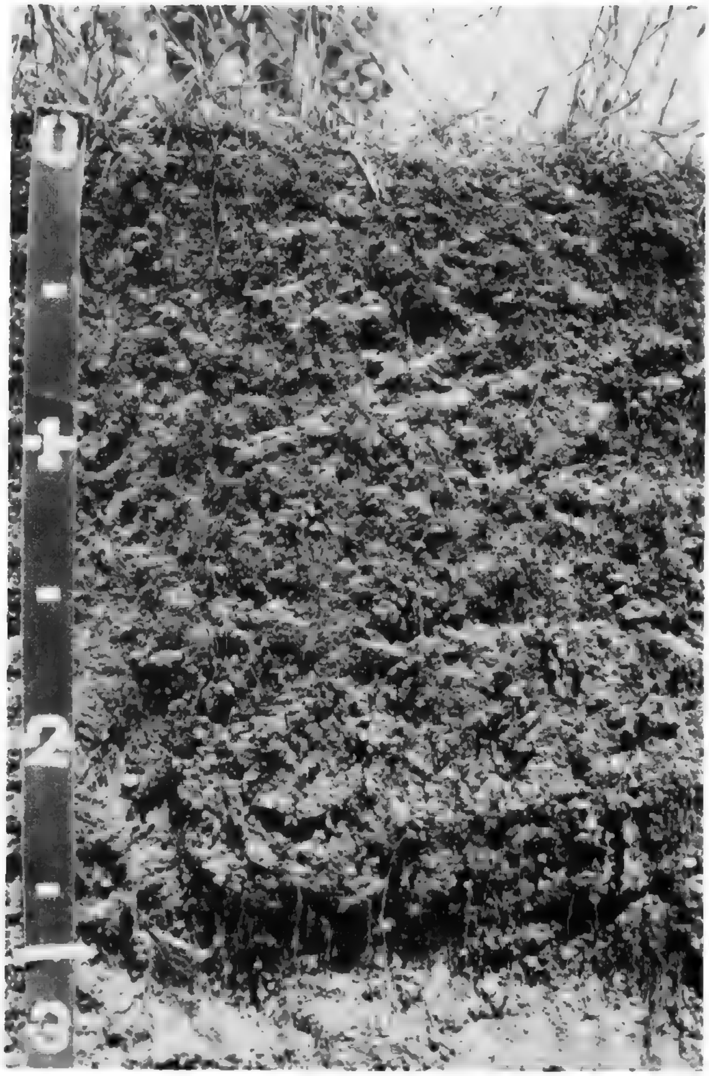

Figure 6.—A profile of Dempster silt loam, 0 to 2 percent slopes. Sand and gravel are at a depth of about 32 inches.

loam in the upper part, brown silt loam in the middle part, and brown loam in the lower part. It is slightly hard when dry and friable when moist. The underlying material is brown, calcareous sand and gravel.

Organic-matter content is moderate, and fertility is medium. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Available water capacity is moderate. Runoff is slow or medium.

Most areas are cultivated. Unless the soils are irrigated, small grain and tame grasses are better suited than corn and alfalfa. A few areas are irrigated. Some areas are a source of sand and gravel for construction material.

Representative profile of Dempster silt loam, 0 to 2 percent slopes, in pasture, 81 feet west and 1,150 feet south of the center of sec. 24, T. 96 N., R. 48 W.:

Ap—0 to 9 inches, dark-gray (10YR 4/1) silt loam that crushes to dark grayish brown (10YR 4/2), black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, medium, subangular blocky structure parting to weak, fine, granular; slightly hard, friable; slightly acid; abrupt, smooth boundary.

B21—9 to 15 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse and medium, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable, slightly sticky; slightly acid; gradual, wavy boundary.

B22—15 to 27 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; weak, coarse and medium, prismatic structure parting to moderate, medium, subangular blocky; slightly hard, friable, slighty sticky; neutral; clear, wavy boundary.

B3—27 to 32 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable; neutral; clear, smooth boundary.

IIC—32 to 60 inches, brown (10YR 5/3) sand and gravel, dark brown (10YR 4/3) when moist; single grained; loose; thin crusts of lime on undersides of pebbles; slight effervescence; mildly alkaline.

Depth to sand and gravel ranges from 20 to 40 inches, and depth to lime ranges from 22 to 40 inches. The A horizon ranges from very dark gray to dark grayish brown. It is loam or silty clay loam that ranges from 5 to 12 inches in thickness. The B2 horizon ranges from dark grayish brown to light yellowish brown in hue of 10YR or 2.5Y. It is silt loam or silty clay loam that ranges from 14 to 18 inches in thickness. In some places there is no B3 horizon, but in most areas a B3, B3ca, or C1ca horizon is immediately above the sand and gravel. Where present, these horizons are loam, silt loam, or silty clay loam. The upper part of the IIC horizon is leached of lime in some places.

Dempster soils are near Graceville, Delmont, and Talmo soils. They are shallower over sand and gravel than Graceville soils. They are deeper over sand and gravel than Delmont and Talmo soils.

Dempster silt loam, 0 to 2 percent slopes (DmA).—This nearly level soil is in irregularly shaped areas that are as much as 200 acres in size. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Graceville soils in shallow swales.

Runoff is slow. The soil is easy to work, but the underlying sand and gravel limit the growth of plant roots. Available water capacity is moderate, and the soil is somewhat droughty. Conserving moisture is the main concern of management.

Most areas are cultivated. Corn, oats, soybeans, and alfalfa are the main crops. Unless the soil is irrigated, small grain and tame grasses are better suited than corn and soybeans. Capability unit IIs–3; pasture group D; windbreak group 6.

Dempster silt loam, 2 to 6 percent slopes (DmB).—Areas of this gently sloping soil are long and narrow and range from 5 to 40 acres in size. The soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thinner.

Included with this soil in mapping are small areas of Delmont soils on the higher parts of the landscape.

Runoff is medium. The underlying sand and gravel limit the growth of plant roots, and the soil is somewhat droughty. Conserving moisture and controlling erosion and soil blowing are the main concerns of management.

Most areas are cultivated. Early-maturing crops, such as oats and tame grasses, are better suited than corn or soybeans. Capability unit IIIs–2; pasture group D; windbreak group 6.

Egan Series

The Egan series consists of deep, well-drained, gently sloping to strongly sloping, silty soils on uplands (fig. 7). These soils formed in silty drift and in the underlying loamy glacial till. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 8 inches thick. The subsoil, about 22 inches thick, is silty clay loam. It is dark brown in the upper part, yellowish brown in the middle part, and grayish brown in the lower part. The upper part is slightly hard when dry and friable when moist. The lower part is calcareous and contains spots of lime that extend into the underlying material. The underlying material is calcareous clay loam that is grayish brown in the upper part and light yellowish brown in the lower part.

Uneroded areas of Egan soils are high in content of organic matter and in fertility. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is medium.

Figure 7.—**A profile of Egan silty clay loam, 3 to 6 percent slopes. White spots in lower part of the subsoil and underlying material are segregations of soft lime.**

Most areas are cultivated. Corn, soybeans, oats, and alfalfa are the main crops. Strongly sloping Egan soils are better suited to tame grasses and legumes for pasture or hay than to other uses. A few areas are in native grass.

Representative profile of Egan silty clay loam, 3 to 6 percent slopes, in a cultivated area, 96 feet west and 1,920 feet north of the southeast corner of sec. 26, T. 99 N., R. 49 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, fine, granular structure; slightly hard, friable, slightly sticky; slightly acid; abrupt, smooth boundary.

B21—8 to 15 inches, dark-brown (10YR 4/3) silty clay loam, very dark grayish brown (10YR 3/2) when moist, crushes to dark brown (10YR 3/3); weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable, slightly sticky; few wormcasts; slightly acid; gradual, wavy boundary.

B22—15 to 25 inches, yellowish-brown (10YR 5/4) silty clay loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable, slightly sticky; few wormcasts; neutral; clear, wavy boundary.

B3ca—25 to 30 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; few, fine, distinct mottles of strong brown (7.5Y 5/6) when moist; weak, coarse and medium, prismatic structure parting to weak, medium, subangular blocky; hard, friable, slightly sticky; few fine iron-manganese concretions; many fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

IIC1—30 to 38 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; few, medium, distinct mottles of olive gray (5Y 5/2) and few, fine, distinct mottles of strong brown (7.5YR 5/6) when moist; weak, coarse, prismatic structure; hard, firm, slightly sticky; few fine iron-manganese concretions; common fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

IIC2—38 to 60 inches, light yellowish-brown (2.5Y 6/3) clay loam, olive brown (2.5Y 4/3) when moist; common, medium, distinct mottles of olive gray (5Y 5/2) and common, fine and medium, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) when moist; weak, coarse, subangular blocky structure; hard, firm, slightly sticky; common fine iron-manganese concretions; few fine segregations of lime; strong effervescence; moderately alkaline.

Thickness of the silty material over loamy glacial till ranges from 20 to 40 inches. Depth to lime ranges from 15 to 30 inches but commonly is 22 to 26 inches. The A horizon ranges from very dark gray to dark grayish brown. It is silty clay loam or silt loam that ranges from 4 to 10 inches in thickness. The B2 horizon has hue of 10YR or 2.5Y and ranges from dark grayish brown to brown in the upper part and from brown to yellowish brown in the lower part. It is silty clay loam or silt loam that ranges from 11 to 20 inches in thickness. In some places there is no B3ca horizon. The IIC horizon is clay loam or loam.

Egan soils are mapped with Chancellor and Shindler soils and are near Viborg and Wentworth soils. They are better drained than Chancellor and Viborg soils. They are more silty and are deeper over lime than Shindler soils. They differ from Wentworth soils in having loamy material within a depth of 40 inches.

Egan silty clay loam, 3 to 6 percent slopes (EaB).—This gently sloping soil is mainly on the sides of drainageways. Areas are mostly long and narrow and range

from 5 to 200 acres in size. Slopes generally are short. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Shindler, Viborg, and Wentworth soils. Shindler soils are on the higher parts of the landscape where slopes are more convex. Viborg soils are in swales. Wentworth soils are on the lower parts of the landscape between Egan and Viborg soils. Also included are some areas of a soil that is similar to this Egan soil, but the surface layer and subsoil are clay loam. Small stony and gravelly spots are included in some areas, and they are identified on the detailed soil map by spot symbols.

Runoff is medium. Fertility is high, and crops grow well on this soil. Controlling erosion is the main concern of management.

Most areas are cultivated. The soil is well suited to all the crops commonly grown in the county. Capability unit IIe–3; pasture group F; windbreak group 3.

Egan-Chancellor silty clay loams, 2 to 4 percent slopes (EcB).—The gently sloping to gently undulating soils in this complex are on uplands in areas that are as much as 600 acres in size. The areas commonly consist of rises interspersed with numerous narrow swales that contain small, circular depressions. This complex is about 45 percent Egan soil, 30 percent Chancellor soil, and 25 percent other soil. The Egan soil is on the rises. The Chancellor soil is in the swales and commonly is nearly level.

Included with these soils in mapping are areas of Tetonka, Viborg, Wakonda, Wentworth, and Worthing soils. Tetonka and Worthing soils are in small depressions. Viborg soils are in some of the swales. Wakonda soils are on narrow rims around the depressions and swales. Wentworth soils are on the lower parts of some of the rises. Small gravelly and stony spots are included on some of the rises, and they are identified on the detailed soil map by spot symbols.

Runoff is medium, and water collects in the swales. Fertility is high on these soils, but spring planting is delayed in some years by wetness on the Chancellor soil. Controlling erosion on the Egan soil and wetness on the Chancellor soil are the main concerns of management.

Most areas of these soils are cultivated. The soils are suited to all crops commonly grown in the county, but late-planted crops are better suited in some years because of wetness on the Chancellor soil. Capability unit IIe–3; Egan soil in pasture group F and windbreak group 3; Chancellor soil in pasture group A and windbreak group 2.

Egan-Shindler complex, 2 to 6 percent slopes (EsB).—The soils in this complex are on uplands along drainageways and on rises around depressions. This complex is about 55 percent Egan soil, 35 percent Shindler soil, and 10 percent other soil. Areas range from 5 to 160 acres in size.

The Egan soil is on the rises and has smooth slopes. Its surface layer is silty clay loam. The Shindler soil is on the higher parts of the landscape where slopes are shorter and more convex. Its surface layer is clay loam. Eroded spots of the Shindler soil in cultivated areas are grayish brown because plowing has mixed the surface layer and subsoil.

Included with these soils in mapping are areas of Viborg and Wentworth soils. Viborg soils are in swales. Wentworth soils are on the lower parts of the rises with Egan soils. Also included are some areas of a soil that is similar to the Egan soil but contains less silt and has a surface layer and subsoil of clay loam. Small gravelly, stony, and wet spots are included in some areas, and they are identified on the detailed soil map by spot symbols.

Runoff is medium. Fertility is high in the Egan soil and medium in the Shindler soil. Controlling erosion is the main concern of management.

Most areas of these soils are cultivated. A few are used for pasture. The soils are suited to all crops commonly grown in the county. Capability unit IIe–3; windbreak group 3; Egan soil in pasture group F, Shindler soil in pasture group G.

Egan-Shindler complex, 6 to 9 percent slopes (EsC).—The soils in this complex are on the sides of drainageways and around depressions. This complex is about 50 percent Egan soil, 40 percent Shindler soil, and 10 percent other soil. Areas are long and narrow and are as much as 200 acres in size.

The Egan soil has smooth slopes and is on the middle and lower parts of the landscape. Its surface layer is silty clay loam, but the profile is less silty than the one described as representative of the Egan series and the lower part of the subsoil commonly is clay loam. The Shindler soil is on the higher parts of the landscape where slopes are shorter and more convex. Its surface layer is clay loam that is grayish brown in eroded spots where plowing has mixed the surface layer and subsoil.

Included with these soils in mapping are small areas of Alcester and Steinauer soils. Alcester soils are on the lower parts of the landscape along drainageways. Steinauer soils are on some of the ridges. Also included are some areas of a soil that is similar to the Egan soil but has a surface layer and subsoil of clay loam. Small gravelly and stony spots are included on the higher parts of the landscape in some areas, and they are identified on the detailed soil map by spot symbols.

Runoff is medium, and the hazard of erosion is severe. Controlling erosion is the main concern of management.

Most areas of these soils are cultivated, but a few remain in native grass and are used for pasture. The soils are better suited to small grain, grasses, and legumes than to row crops. Capability unit IIIe–2; windbreak group 3; Egan soil in pasture group F, Shindler soil in pasture group G.

Egan-Worthing complex, 2 to 6 percent slopes (EwB).—The gently undulating soils in this complex are on uplands in areas that contain many enclosed depressions ranging from less than 1 acre to 4 acres in size. This complex is about 50 percent Egan soil, 30 percent Worthing soil, and 20 percent other soil.

The Worthing soil is in depressions. Its surface layer commonly is silty clay, but in places it is silty clay loam. The Egan soil has a surface layer of silty clay loam.

Included with these soils in mapping are small areas of Chancellor, Huntimer, Shindler, and Wentworth soils. Chancellor soils are in swales. Huntimer soils are on small, mesalike hilltops. Shindler soils are on the

upper sides of ridges and knolls. Wentworth soils are intermingled with Egan soils. Small gravelly or stony spots are included in some areas, and they are identified on the detailed soil map by spot symbols.

Runoff is medium, and water ponds on the Worthing soil. Spring planting commonly is delayed by wetness on the Worthing soil. Controlling erosion and wetness on the Worthing soil are the main concerns of management.

Most areas of these soils are cultivated. Undrained areas of the Worthing soil are better suited to pasture, hay, and wildlife habitat than to other uses. Capability unit IIe–3; Egan soil in pasture group F and windbreak group 3; Worthing soil in pasture group A if drained and B if not drained and in windbreak group 10.

Graceville Series

The Graceville series consists of deep, moderately well drained, nearly level, silty soils in swales and slightly depressed flats on high stream terraces. These soils formed in silty material underlain by outwash sand and gravel at a depth of more than 40 inches. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark-gray silty clay loam about 18 inches thick. The subsoil is silty clay loam about 29 inches thick. It is dark grayish brown in the upper part, dark brown in the middle part, and yellowish brown in the lower part. It is hard when dry and firm when moist. The underlying material is dark yellowish-brown medium sand and gravel.

Organic-matter content and fertility are high. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Available water capacity is high. Runoff is slow. Many areas receive runoff from adjacent soils. This additional moisture is beneficial in most years.

All the areas are cultivated. Corn, oats, soybeans, and alfalfa are the main crops.

Representative profile of Graceville silty clay loam, in a cultivated area, 144 feet north and 1,200 feet east of the southwest corner of sec. 13, T. 96 N., R. 48 W.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, fine, granular structure; hard, friable, slightly sticky; neutral; abrupt, smooth boundary.

A12—8 to 18 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, medium, subangular blocky structure parting to weak, fine, granular; hard, friable, slightly sticky; neutral; clear, wavy boundary.

B21—18 to 24 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist, crushes to very dark grayish brown (10YR 3/2); few tongues of black (10YR 2/1) when moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, firm, slightly sticky and slightly plastic; neutral; clear, wavy boundary.

B22—24 to 32 inches, dark-brown (10YR 4/3) silty clay loam, very dark grayish brown (10YR 3/2) when moist, crushes to dark brown (10YR 3/3); moderate, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, firm, slightly sticky and slightly plastic; few wormcasts; neutral; gradual, wavy boundary.

B23—32 to 47 inches, yellowish-brown (10YR 5/4) silty clay loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, firm, slightly sticky and slightly plastic; slightly acid; clear, wavy boundary.

IIC—47 to 60 inches, dark yellowish-brown (10YR 4/4) medium sand and gravel, dark yellowish brown (10YR 3/4) when moist; single grained; loose; neutral.

Depth to sand and gravel commonly is 45 to 50 inches but ranges from 40 to 60 inches. The A horizon ranges from very dark gray to dark grayish brown. It is silty clay loam or silt loam that ranges from 12 to 20 inches in thickness. The B2 horizon ranges from dark grayish brown to yellowish brown in hue of 10YR or 2.5Y. It is 30 to 35 percent clay but contains thin layers that are as much as 38 percent clay. In some places there is a thin B3 or C horizon of silty clay loam, silt loam, or loam immediately above the IIC horizon. The IIC horizon ranges from fine sand to gravel and is calcareous in some places.

Graceville soils are mapped with Delmont soils and are near Alcester, Davis, and Dempster soils. Their profile resembles that of Viborg soils. They differ from Alcester, Davis, and Viborg soils in having sand and gravel at a depth of less than 60 inches. They are deeper over sand and gravel than Delmont and Dempster soils.

Graceville silty clay loam (0 to 2 percent slopes) (Gr).—This nearly level soil is on high terraces along streams. Areas are as much as 400 acres in size. In places the long, smooth slopes are broken by narrow, low ridges.

Included with this soil in mapping are small areas of Dempster soils on low ridges.

Runoff is slow. Some of the areas receive runoff from adjacent sloping soils. Fertility is high. The soil has few or no limitations to use for crops.

All areas are cultivated. Corn, oats, soybeans, and alfalfa are the main crops. Capability unit I–3; pasture group K; windbreak group 1.

Huntimer Series

The Huntimer series consists of deep, well-drained, nearly level, silty soils that have a clayey subsoil. These soils are on uplands. They formed in glacial sediment of ancient, ice-walled lakes. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark-gray silty clay loam about 13 inches thick. The subsoil is about 21 inches thick. It is dark-gray silty clay loam in the upper part, grayish-brown silty clay in the middle part, and light olive-brown, calcareous silty clay in the lower part. The upper part is hard when dry and friable when moist. The middle and lower parts are hard when dry, firm when moist, and sticky and plastic when wet. The underlying material is light yellowish-brown, calcareous silty clay loam.

Organic-matter content and fertility are high. Permeability is slow, and available water capacity is moderate or high. Runoff is slow.

Most areas are cultivated. Corn, soybeans, oats, and alfalfa are the main crops. A few areas are used for pasture or hay.

Representative profile of Huntimer silty clay loam, 0 to 2 percent slopes, in a cultivated area, 810 feet east and 303 feet north of the southwest corner of sec. 18, T. 100 N., R. 50 W.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam,

black (10YR 2/1) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky; neutral; abrupt, smooth boundary.

A12—8 to 13 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak, coarse, prismatic structure parting to weak, fine, granular; slightly hard, friable, slightly sticky; few wormcasts; neutral; gradual, wavy boundary.

B21—13 to 19 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist, crushes to very dark grayish brown (2.5Y 3/2); weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; distinct shiny coats on faces of peds; few wormcasts; neutral; gradual, wavy boundary.

B22—19 to 25 inches, grayish-brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) when moist, crushes to dark grayish brown (2.5Y 4/2); common tongues of black (10YR 2/1) when moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, firm, sticky and plastic; distinct shiny coats on faces of peds; neutral; clear, wavy boundary.

B3ca—25 to 34 inches, light olive-brown (2.5Y 5/3) silty clay, dark grayish brown (2.5Y 4/2) when moist, crushes to olive brown (2.5Y 4/3); few tongues of black (10YR 2/1) when moist; few, fine, distinct mottles of yellowish brown (10YR 5/6) and olive gray (5Y 5/2) when moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, firm, sticky and plastic; distinct shiny coats on faces of peds; common fine and medium segregations of lime, strong effervescence; moderately alkaline; gradual, wavy boundary.

C1ca—34 to 45 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) when moist; common, medium and coarse, distinct mottles of olive gray (5Y 5/2) and many, medium, distinct mottles of yellowish brown (10YR 5/6) when moist; weak, thick, platy structure; hard, firm, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—45 to 60 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) when moist; many, medium and coarse, distinct mottles of yellowish brown (10YR 5/6) and olive gray (5Y 5/2) when moist; weak, coarse, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine iron concretions; few medium segregations of gypsum; strong effervescence; moderately alkaline.

Depth to lime ranges from 18 to 32 inches. The A horizon is very dark gray or dark gray and ranges from 7 to 13 inches in thickness. The B2 horizon ranges from dark gray to light olive brown in hue of 10YR or 2.5Y. It ranges from 11 to 22 inches in thickness, and in some places the lower part is calcareous. The B3ca horizon is silty clay or silty clay loam that ranges from 6 to 10 inches in thickness. The C horizon is silty clay, silty clay loam, or silt loam.

Huntimer soils are near Chancellor, Egan, Shindler, Viborg, and Wentworth soils. They are better drained than Chancellor soils. They have a more clayey B horizon than Egan, Shindler, Viborg, and Wentworth soils.

Huntimer silty clay loam, 0 to 2 percent slopes (HuA).—This nearly level soil is on mesalike hilltops on uplands. Areas are circular in shape and range from 5 to 140 acres in size.

Included with this soil in mapping are small areas of Chancellor soils in swales. These included soils make up less than 5 percent of the mapped areas.

Runoff is slow. The clayey subsoil takes in water slowly and releases it slowly to plants. The soil dries slowly and loses its tilth if it is farmed when wet. Maintaining tilth and improving the water intake are the main concerns of management.

Most areas are cultivated. The soil is suited to all crops commonly grown in the county. Capability unit IIs–2; pasture group I; windbreak group 4.

Lamo Series

The Lamo series consists of deep, somewhat poorly drained, level and nearly level, calcareous, silty soils on bottom lands. These soils formed in alluvium. The native vegetation was mainly tall grasses and stringers of native trees and shrubs along stream channels.

In a representative profile the soil is very dark gray, calcareous silty clay loam that extends to a depth of 60 inches or more.

Organic-matter content and fertility are high. Permeability is moderately slow, and available water capacity is high. Runoff is slow. These soils are subject to flooding from stream overflow in some years. The water table is at a depth of 2 to 8 feet.

The larger areas are cultivated. Corn, soybeans, oats, and alfalfa are the main crops. Many of the narrow areas are in native grass and are used for pasture or hay.

Representative profile of Lamo silty clay loam, in a cultivated area, 80 feet north and 710 feet west of the southwest corner of sec. 23, T. 96 N., R. 49 W.:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; weak, medium and fine, granular structure; slightly hard, friable, slightly sticky; slight effervescence; mildly alkaline; abrupt, smooth boundary.

A12—9 to 15 inches, very dark gray (2.5Y 3/1) silty clay loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure parting to weak, fine, granular; slightly hard, friable, slightly sticky; strong effervescence; moderately alkaline; gradual, wavy boundary.

A13—15 to 28 inches, very dark gray (5Y 3/1) silty clay loam, black (5Y 2/1) when moist; few, fine, faint mottles of olive gray when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky; strong effervescence; moderately alkaline; gradual, wavy boundary.

C1g—28 to 40 inches, very dark gray (5Y 3/1) silty clay loam, black (5Y 2/1) when moist; few, fine and medium, faint mottles of olive gray and olive when moist; weak, coarse and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2g—40 to 60 inches, very dark gray (5Y 3/1) silty clay loam, black (5Y 2/1) when moist; few, fine and medium, faint mottles of olive gray when moist; massive; hard, firm, sticky and plastic; slight effervescence; moderately alkaline.

Depth to free carbonates ranges from 0 to 8 inches. The C horizon in some places is stratified with thin layers of silty clay and silt loam. Sand and gravel are below a depth of 40 inches in some places.

Lamo soils in Lincoln County have thicker horizons that have colors of black or very dark gray when moist than the defined range for the series, but this difference does not alter the usefulness or behavior of the soils.

Lamo soils are on bottom lands, as are Alcester, Bon, Clamo, Luton, and Salmo soils. They are more poorly drained than Alcester and Bon soils. They contain less clay than Clamo and Luton soils and less salts than Salmo soils.

Lamo silty clay loam (0 to 1 percent slopes) (La).—This level soil is on bottom lands. Some of the areas are long and narrow, but the wider areas are as much as 400 acres in size.

Included with this soil in mapping are areas of Al-

cester and Clamo soils. Alcester soils are on the edges of the areas at slightly higher elevations. Clamo soils are in low areas. These included soils make up less than 10 percent of the mapped areas.

Runoff is slow. The soil is flooded in some years, and it has a high water table. Spring planting is delayed in some years by wetness. Controlling wetness and maintaining tilth are the main concerns of management.

The larger areas are cultivated, but many of the narrow areas are used for pasture. If the soil is adequately drained, it is suited to all the crops commonly grown in the county. Undrained areas are better suited to late-planted crops or to pasture, hay, or wildlife habitat than to other uses. Capability unit IIw–3 if drained and IVw–2 if not drained; pasture group A if drained and B if not drained; windbreak group 2.

Luton Series

The Luton series consists of deep, poorly drained, level, clayey soils. These soils are on bottom lands along the larger streams. They formed in alluvium. The native vegetation was mainly tall grasses and sedges.

In a representative profile the surface layer is very dark gray silty clay about 18 inches thick. The subsoil, about 30 inches thick, is silty clay that is very dark gray in the upper part and olive gray in the lower part. The lower part of the surface layer and the subsoil are very hard when dry, very firm when moist, and sticky and plastic when wet. The underlying material is gray, calcareous silty clay.

Organic-matter content and fertility are high. Permeability is very slow, and available water capacity is low or moderate. Runoff is very slow. These soils are subject to flooding from stream overflow in some years. The water table commonly is at a depth of 2 to 8 feet, but it is near the surface for short periods during wet years.

Luton soils are used for hay, pasture, or crops. Corn, soybeans, oats, and sorghum are the main crops where drainage is adequate. Undrained areas are better suited to grasses and legumes than to other uses.

Representative profile of Luton silty clay, in a hayfield, 183 feet south and 890 feet east of the northwest corner of sec. 30, T. 97 N., R. 51 W.:

A11—0 to 11 inches, very dark gray (N 3/0) silty clay, black (N 2/0) when moist; moderate, fine, subangular blocky structure; very hard, firm, sticky and plastic; neutral; clear, wavy boundary.

A12—11 to 18 inches, very dark gray (N 3/0) silty clay, black (N 2/0) when moist; moderate, medium and fine, subangular blocky structure; very hard, very firm, sticky and plastic; neutral; clear, wavy boundary.

B21g—18 to 34 inches, very dark gray (N 3/0) silty clay, black (N 2/0) when moist; moderate, medium and fine, blocky structure; very hard, very firm, sticky and plastic; peds have distinct shiny faces; neutral; gradual, wavy boundary.

B22g—34 to 40 inches, very dark gray (5Y 3/1) silty clay, black (5Y 2/1) when moist; few, fine, distinct mottles of light olive brown (2.5Y 5/6) and few, medium, faint mottles of dark olive gray and olive gray when moist; weak, medium, prismatic structure parting to moderate, medium, blocky; very hard, very firm, sticky and plastic; peds have distinct shiny faces; few fine segregations of lime; neutral; clear, wavy boundary.

B3g—40 to 48 inches, olive-gray (5Y 4/2) silty clay, dark olive gray (5Y 3/2) when moist; few fine, faint mottles of light olive brown when moist; common, fine, distinct mottles of black (N 2/0) when moist; moderate, medium, blocky structure; very hard, very firm, sticky and plastic; peds have distinct shiny faces; few fine segregations of lime; strong effervescence; mildly alkaline; gradual, wavy boundary.

Cg—48 to 60 inches, gray (5Y 5/1) silty clay, olive gray (5Y 4/2) when moist; common, medium, faint mottles of dark olive gray (5Y 3/2) and light olive brown (2.5Y 5/6) and few, fine, faint mottles of dark gray when moist; weak, coarse and medium, subangular blocky structure; hard, firm, sticky and plastic; peds have distinct shiny faces; few fine iron concretions; common fine segregations of lime; strong effervescence; moderately alkaline.

Horizons that are very dark gray or black when moist extend to a depth of 24 to 40 inches. The A horizon is silty clay or clay that ranges from 12 to 22 inches in thickness. The B horizon is silty clay or clay that ranges from 16 to 28 inches in thickness. The C horizon is silty clay, clay, or silty clay loam that in some places is stratified with thin layers of sand at a depth of more than 40 inches.

Luton soils are on bottom lands, as are Clamo and Lamo soils. They are more clayey than those soils.

Luton silty clay (0 to 1 percent slopes) (Lu).—This level soil is on bottom lands along the larger streams. Included in mapping are small areas of Clamo soils at slightly higher elevations.

Runoff is slow, and permeability is very slow. Wetness from flooding and from a high water table commonly delays spring seeding. The soil dries slowly, and it compacts if it is farmed when wet. Wetness and maintaining tilth are the main concerns of management.

If the soil is adequately drained and protected from flooding, it is well suited to corn, soybeans, oats, and sorghum. Undrained areas are better suited to grasses and legumes or to wildlife habitat than to other uses. Capability unit IIIw–2 if drained and Vw–2 if not drained; pasture group A if drained and B if not drained; windbreak group 2 if drained and 10 if not drained.

Marsh

Marsh (Mh) consists of shallow basins or depressions in the uplands. Slopes are 0 to 1 percent. The areas are circular in shape and range from 4 to 40 acres in size. Runoff is ponded, and water is on or at the surface most of the time.

The vegetation consists mainly of rushes, cattails, and other aquatic plants that are unpalatable to livestock. In dry years wild hay can be mowed on the edges of the areas. The areas are better suited to wildlife habitat than to other uses. Capability unit VIIIw–1; not assigned to a pasture group or windbreak group.

Moody Series

The Moody series consists of deep, well-drained, nearly level to sloping, silty soils on uplands. These soils formed in loess (fig. 8). The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 6 inches thick. The

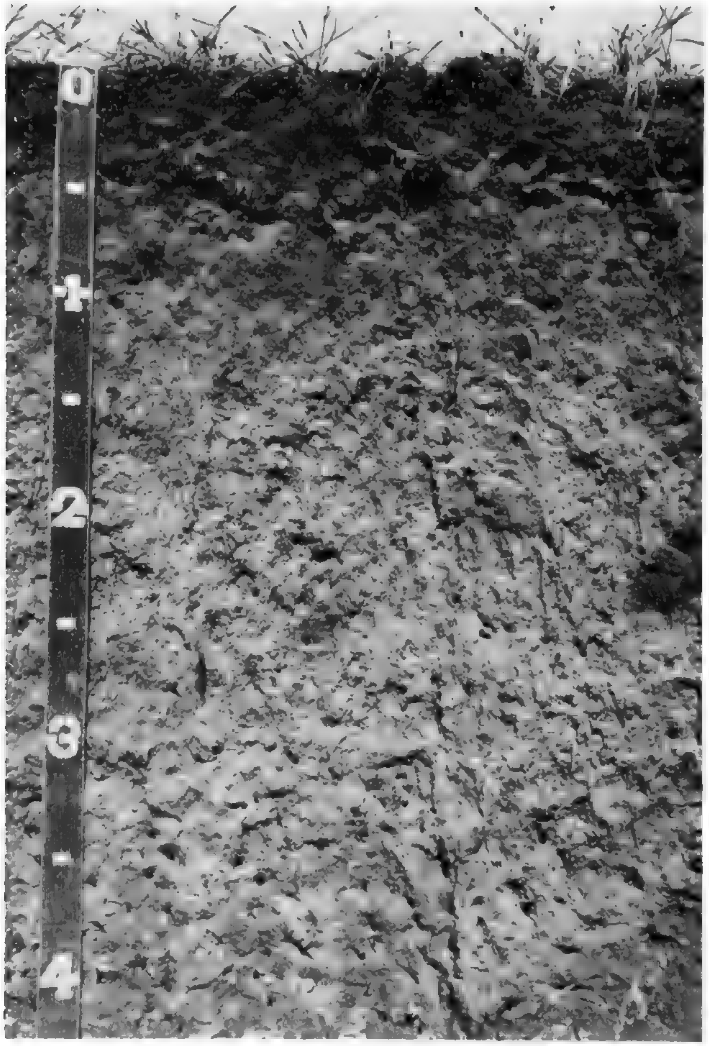

Figure 8.—**A profile of Moody silty clay loam, 2 to 6 percent slopes. This soil formed in uniformly silty material.**

subsoil is about 32 inches thick. It is dark grayish-brown silty clay loam in the upper part, brown and pale-brown silty clay loam in the middle part, and pale-brown silt loam in the lower part. It is hard when dry and friable when moist. The underlying material is light yellowish-brown, calcareous silt loam.

Organic-matter content is moderate or high, and fertility is medium or high. Permeability is moderate, and available water capacity is high. Runoff is slow or medium.

Most areas are cultivated. Corn, oats, soybeans, and alfalfa are the main crops.

Representative profile of Moody silty clay loam, 2 to 6 percent slopes, in a cultivated area, 69 feet south and 1,010 feet west of the northeast corner of sec. 14, T. 96 N., R. 49 W.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist, crushes to very dark grayish brown (10YR 3/2); weak, fine, granular structure; slightly hard, friable; slightly acid; abrupt, smooth boundary.

B21—6 to 10 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist, crushes to dark brown (10YR 3/3); weak, medium, prismatic structure parting to weak, medium, subangular blocky; hard, friable, slightly sticky; slightly acid; clear, smooth boundary.

B22—10 to 18 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky; few wormcasts; neutral; clear, wavy boundary.

B23—18 to 28 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) when moist, crushes to olive brown (2.5Y 4/4); weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; neutral; gradual, wavy boundary.

B3—28 to 38 inches, pale-brown (10YR 6/3) silt loam, light olive brown (2.5Y 5/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; slightly acid; clear, wavy boundary.

C1ca—38 to 47 inches, light yellowish-brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) when moist; few, fine, distinct mottles of gray (5Y 5/1) when moist; weak, coarse, subangular blocky structure; slightly hard, very friable; few, fine and medium, distinct stains of yellowish brown (10YR 5/8) when moist; common fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—47 to 60 inches, light yellowish-brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) when moist; common, fine, distinct mottles of gray (5Y 5/1) when moist; massive; soft, very friable; few, fine, distinct stains of yellowish brown (10YR 5/8) and light olive brown (2.5Y 5/6) when moist; few fine segregations of lime; strong effervescence; moderately alkaline.

Depth to lime ranges from 30 to 50 inches. The A horizon is very dark grayish brown or dark grayish brown and ranges from 5 to 10 inches in thickness. The B21 horizon is dark grayish brown or grayish brown and ranges from 4 to 6 inches in thickness. The rest of the B2 horizon ranges from brown to light yellowish brown in hue of 10YR or 2.5Y. The B3 horizon is calcareous in some places.

The Moody part of mapping unit MpC2 in Lincoln County has a thinner, lighter colored A horizon than the defined range for the Moody series. This difference affects the placement of the soil in the capability grouping but otherwise does not alter its usefulness and behavior.

Moody soils are mapped with or are near Crofton and Nora soils and are similar to Wentworth soils. They are deeper over lime than Crofton and Nora soils. They have a more silty C horizon than Wentworth soils.

Moody silty clay loam, 0 to 2 percent slopes (MoA).—This nearly level soil is on uplands. Areas range from 5 to 275 acres in size. Slopes are long and smooth. The soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thicker.

Included with this soil in mapping are small areas of Nora soils on slight rises. Also included are some areas of a moderately well drained soil that is similar to this Moody soil but has a thicker surface layer and is deeper over lime. This soil is in slight depressions or shallow swales. These included soils make up less than 10 percent of the mapped areas.

Runoff is slow. Fertility is high. The soil has few or no limitations to use for crops.

All areas are cultivated. The soil is well suited to all crops commonly grown in the county. Capability unit I–2; pasture group F; windbreak group 3.

Moody silty clay loam, 2 to 6 percent slopes (MoB).—This gently sloping soil is on uplands. Areas are as much as 900 acres in size. Slopes are long and smooth (fig. 9). The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Alcester and Nora soils. Alcester soils are in low areas along drainageways. Nora soils are on the upper sides of ridges and knolls. These included soils make up about 15 percent of the mapped areas.

Runoff is medium, and the hazard of erosion is moderate. Fertility is high. Controlling water erosion and soil blowing is the main concern of management.

Almost all areas are cultivated. The soil is well suited to all crops commonly grown in the county. Capability unit IIe–3; pasture group F; windbreak group 3.

Moody-Nora silty clay loams, 2 to 6 percent slopes (MpB).—This complex is about 60 percent Moody soil, 30 percent Nora soil, and 10 percent other soil. Slopes are smooth and in most areas are broken by drainageways.

The Moody soil has long, smooth slopes and is on the middle and lower parts of the landscape. The Nora soil is on the higher parts of the landscape and has shorter, more convex slopes.

Included with these soils in mapping are small areas of Alcester and Crofton soils. Alcester soils are in low areas along drainageways. Crofton soils are on the tops and upper sides of some of the ridges and knolls.

Runoff is medium, and the hazard of erosion is moderate. Controlling water erosion and soil blowing is the main concern of management.

Almost all areas of these soils are cultivated. The soils are well suited to all crops commonly grown in the county. Capability unit IIe–3; pasture group F; windbreak group 3.

Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded (MpC2).—This complex is about 45 percent Moody soil, 35 percent Nora soil, and 20 percent other soil. The areas are as much as 1,200 acres in size. Slopes are long and smooth, and the soils are moderately eroded to severely eroded (fig. 10).

The Moody soil is on the middle and lower parts of the landscape. The Nora soil has steeper, more convex slopes and is on the upper sides of ridges and knolls. It has the profile described as representative of the Nora series. Eroded areas of both Moody and Nora soils, however, have a grayish-brown surface layer because the surface layer and subsoil have been mixed by plowing.

Included with these soils in mapping are areas of Alcester and Crofton soils. Alcester soils are on bottom

Figure 9.—**Slopes are long and smooth in this area of Moody silty clay loam, 2 to 6 percent slopes.**

Figure 10.—**Area of Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded.**

lands and fans along drainageways. Crofton soils are on the tops and upper sides of ridges and knolls and generally are the most severely eroded parts of the mapped areas.

Runoff is medium, and the hazard of erosion is severe. Because of erosion, these soils have lower fertility and contain less organic matter than is typical for their series. Controlling water erosion and soil blowing and improving fertility and organic-matter content are the main concerns of management.

Most areas of these soils are cultivated. If protective measures are used, the soils are suited to all crops commonly grown in the county. Capability unit IVe-1; pasture group F; windbreak group 3.

Nora Series

The Nora series consists of deep, well-drained, gently sloping to strongly sloping, silty soils on uplands. These soils formed in loess. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 7 inches thick. The subsoil is pale-brown silt loam about 23 inches thick. It is slightly hard when dry and friable when moist. The lower part is calcareous and has spots of soft lime that extend into the underlying material. The underlying material is light yellowish-brown, calcareous silt loam.

Organic-matter content is moderate or low, and fertility is medium or low. Permeability is moderate, and available water capacity is high. Runoff is medium or rapid.

Many areas are cultivated. Corn, oats, soybeans, and alfalfa are the main crops. Strongly sloping Nora soils are better suited to pasture or hay than to other uses. A few areas are in native grass and are used for pasture.

Nora soils in Lincoln County are mapped only with Crofton and Moody soils.

Representative profile of Nora silty clay loam in a cultivated area of Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded, 102 feet north and 550 feet west of the southeast corner of sec. 20, T. 96 N., R. 49 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, friable; neutral; abrupt, smooth boundary.

B21—7 to 11 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 3/3) when moist, crushes to dark brown (10YR 4/3); few tongues of very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; neutral; clear, wavy boundary.

B22—11 to 18 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist, crushes to olive brown (2.5Y 4/4); weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; neutral; gradual, wavy boundary.

B23—18 to 22 inches, pale-brown (10YR 6/3) silt loam, olive brown (2.5Y 4/4) when moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; neutral; clear, wavy boundary.

B3ca—22 to 30 inches, pale-brown (10YR 6/3) silt loam,

light olive brown (2.5Y 5/4) when moist; few, fine, distinct mottles of gray (5Y 5/1) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; few, fine, distinct stains of yellowish brown (10YR 5/8) when moist; common fine segregations of lime; strong effervescence; mildly alkaline; gradual, wavy boundary.

C1ca—30 to 36 inches, light yellowish-brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) when moist; weak, coarse, subangular blocky structure; slightly hard, very friable; common, medium, distinct stains of yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) when moist; common fine concretions of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—36 to 60 inches, light yellowish-brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) when moist; common, fine, distinct mottles of gray (5Y 5/1) when moist; very weak, coarse, subangular blocky structure; soft, very friable; few, fine, distinct stains of yellowish brown (10YR 5/8) when moist; few fine concretions of lime; strong effervescence; moderately alkaline.

Depth to lime ranges from 12 to 30 inches. The A horizon commonly is dark grayish brown, but it is grayish brown in eroded areas. It is silty clay loam or silt loam that ranges from 4 to 7 inches in thickness. The B2 horizon ranges from brown to light yellowish brown in hue of 10YR or 2.5Y. It is silt loam or silty clay loam that ranges from 9 to 17 inches in thickness. The B3ca horizon ranges from 6 to 10 inches in thickness.

The Nora part of mapping units MpC2 and CpD2 in Lincoln County has a thinner, lighter colored A horizon than the defined range for the Nora series. This difference affects the placement of the soils in the capability grouping but otherwise does not alter their usefulness and behavior.

Nora soils are mapped with Crofton and Moody soils. In contrast with Crofton soils, they have a B horizon and are deeper over lime. They have a thinner B horizon and are more shallow to lime than Moody soils.

Renner Series

The Renner series consists of deep, well-drained, moderately steep to steep, loamy soils on uplands. These soils formed in local alluvium and in the underlying glacial till. The native vegetation was mainly tall and mid grasses and deciduous trees and shrubs.

In a representative profile about one-half inch of forest litter is on the surface. Below this, the surface layer is dark-gray loam about 18 inches thick. The subsoil is clay loam about 28 inches thick. It is dark gray in the upper part, dark grayish brown in the middle part, and light olive brown in the lower part. It is hard when dry and firm when moist. The underlying material is light olive-brown, calcareous clay loam.

Organic-matter content and fertility are high. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is medium.

Most areas are in woodland or pasture and are used for grazing, wildlife habitat, and recreation.

Renner soils in Lincoln County are mapped only with Shindler soils.

Representative profile of Renner loam in a wooded area of Shindler-Renner complex, 15 to 40 percent slopes, 1,015 feet north and 150 feet east of the center of sec. 13, T. 97 N., R. 49 W.:

O1—½ inch to 0, very dark grayish-brown (10YR 3/2) and dark grayish-brown (10YR 4/2), unaltered and partly decomposed forest litter.

A11—0 to 10 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, medium and fine, granular structure; slightly hard, friable; slightly acid; gradual, wavy boundary.

A12—10 to 18 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable; few wormcasts; slightly acid; gradual, wavy boundary.

B21t—18 to 29 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, coarse, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, firm, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; few wormcasts; slightly acid; gradual, wavy boundary.

B22t—29 to 40 inches, dark grayish-brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) when moist, crushes to olive brown (2.5Y 4/3); few, fine, distinct mottles of yellowish brown (10YR 5/6) when moist; moderate, medium, prismatic structure parting to moderate, medium and fine, subangular blocky and blocky; hard, firm, sticky and plastic; thin patchy clay films on faces of peds; few wormcasts; few fine iron-manganese concretions; slightly acid; gradual, wavy boundary.

B3—40 to 46 inches, light olive-brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) when moist; few, fine, distinct mottles of yellowish brown (10YR 5/6) and very dark brown (10YR 2/2) when moist; weak, very coarse and coarse, prismatic structure parting to weak, coarse and medium, subangular blocky and blocky; hard, firm, sticky and plastic; few fine iron-manganese concretions; neutral; clear, wavy boundary.

Cca—46 to 60 inches, light olive-brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) when moist; few, fine, distinct mottles of strong brown (7.5Y 5/6) and very dark brown (10YR 2/2) when moist; weak, very coarse and coarse, subangular blocky structure; hard, firm, sticky and plastic; few fine iron-manganese concretions; common fine and medium segregations of lime; slight effervescence; mildly alkaline.

Depth to free carbonates ranges from 28 to 60 inches. The A horizon ranges from very dark gray to dark grayish brown. It is loam or silt loam that ranges from 10 to 22 inches in thickness. The B2t horizon ranges from very dark gray to light olive brown and is 30 to 35 percent clay. It ranges from 18 to 28 inches in thickness. The B3 horizon contains segregations of lime in some places. Pockets of medium and fine sand are at a depth of 40 inches or more in some places.

Renner soils are mapped with Shindler soils and have profiles similar to Alcester and Davis soils. They have a thicker A horizon than Shindler soils. They contain less silt than Alcester soils and more clay in the B horizon than Davis soils.

Salmo Series

The Salmo series consists of deep, very poorly drained, level, silty soils that are high in content of salt. These soils are on bottom lands. They formed in alluvium. The native vegetation was mainly tall and mid grasses and sedges.

In a representative profile the surface layer is very dark gray and dark-gray, calcareous silty clay loam about 20 inches thick. The lower part is hard when dry and friable when moist. The underlying material is gray, calcareous silty clay loam. Spots and streaks of gypsum and other salts occur throughout the profile.

Organic-matter content is high, and fertility is medium. Permeability is moderately slow, and available water capacity is high. Runoff is very slow. These soils

are flooded frequently. The water table is within 2 feet of the surface.

Most areas are in native vegetation and are used for pasture and hay. These soils are too wet for cultivated crops.

Representative profile of Salmo silty clay loam, very wet, in a pasture, 78 feet north and 1,970 feet west of the southeast corner of sec. 25, T. 98 N., R. 50 W.:

A11sa—0 to 9 inches, very dark gray (N 3/0) silty clay loam, black (N 2/0) when moist; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, friable, slightly sticky; many fine segregations of salt; strong effervescence; mildly alkaline; gradual, wavy boundary.

A12sacs—9 to 20 inches, dark-gray (N 4/0) silty clay loam, black (5Y 2/1) when moist; weak, coarse and medium, subangular blocky structure parting to weak, fine, granular; hard, friable, slightly sticky; common fine nests of gypsum crystals; common fine segregations of salt; strong effervescence; mildly alkaline; gradual, wavy boundary.

C1gcs—20 to 38 inches, gray (5Y 5/1) silty clay loam, black (5Y 2/1) when moist; common, fine, faint mottles of olive gray when moist; weak, coarse and medium, subangular blocky structure; hard, friable, slightly sticky; many fine nests of gypsum crystals; few fine segregations of salt; strong effervescence; mildly alkaline; gradual, wavy boundary.

C2gcs—38 to 50 inches, gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) when moist; common, fine and medium, faint mottles of black when moist; weak, very coarse and coarse, subangular blocky structure; hard, friable, slightly sticky; many fine and medium nests of gypsum crystals; strong effervescence; mildly alkaline; gradual, wavy boundary.

C3gcs—50 to 60 inches, gray (5Y 6/1) silty clay loam, dark gray (5Y 4/1) when moist; many, medium and coarse, faint mottles of gray (5Y 5/1), common, fine, distinct mottles of black (5Y 2/1), and few, medium, distinct mottles of yellowish brown (10YR 5/6) when moist; massive; hard, sticky and plastic; many medium nests of gypsum crystals; strong effervescence; mildly alkaline.

The entire profile is silty clay loam or silt loam, but there are thin layers of silty clay in some places. The greatest accumulations of salts other than gypsum are in the A horizon. Electrical conductivity of the saturation extract ranges from 4 to 10 in the upper 20 inches and from 3 to 10 below a depth of 20 inches. The A horizon has hue of 10YR, 2.5Y, and 5Y or is neutral. It ranges from 11 to 25 inches in thickness. The C horizon ranges from dark gray to light olive gray in hue of 2.5Y or 5Y or is neutral. In some places layers of sand and gravel are at a depth of 40 inches or more.

Salmo soils in Lincoln County are wetter than the defined range for the series. This difference affects their suitability for cultivation but does not alter their usefulness and behavior for other uses.

Salmo soils are near Clamo and Lamo soils. They contain more salts than those soils.

Salmo silty clay loam, very wet (0 to 1 percent slopes) (Sa).—This level soil is on bottom lands. Areas are long and narrow and are as much as 600 acres in size.

Included with this soil in mapping are small areas of Lamo soils on the edges of the areas at slightly higher elevations.

Runoff is very slow. This soil is flooded frequently from stream overflow, and the water table is commonly at or near the surface during part of the growing season. Salts are also at or near the surface. Wetness and salinity are the main concerns of management.

Most areas remain in native vegetation and are used for pasture or hay. Capability unit Vw-1; pasture group J; windbreak group 10.

Shindler Series

The Shindler series consists of deep, well-drained, gently undulating to steep, loamy soils on uplands. These soils formed in glacial till. The native vegetation was mainly tall and mid grasses, but deciduous trees and shrubs were in some areas.

In a representative profile (fig. 11), the surface layer is dark-gray clay loam about 7 inches thick. The subsoil is calcareous clay loam about 10 inches thick. It is dark gray and grayish brown in the upper part and light olive brown in the lower part. The upper part is hard when dry and friable when moist. The underlying material is light yellowish-brown, calcareous clay loam.

Organic-matter content is moderate, and fertility is medium or low. Permeability is moderate in the subsoil and moderately slow in the underlying material.

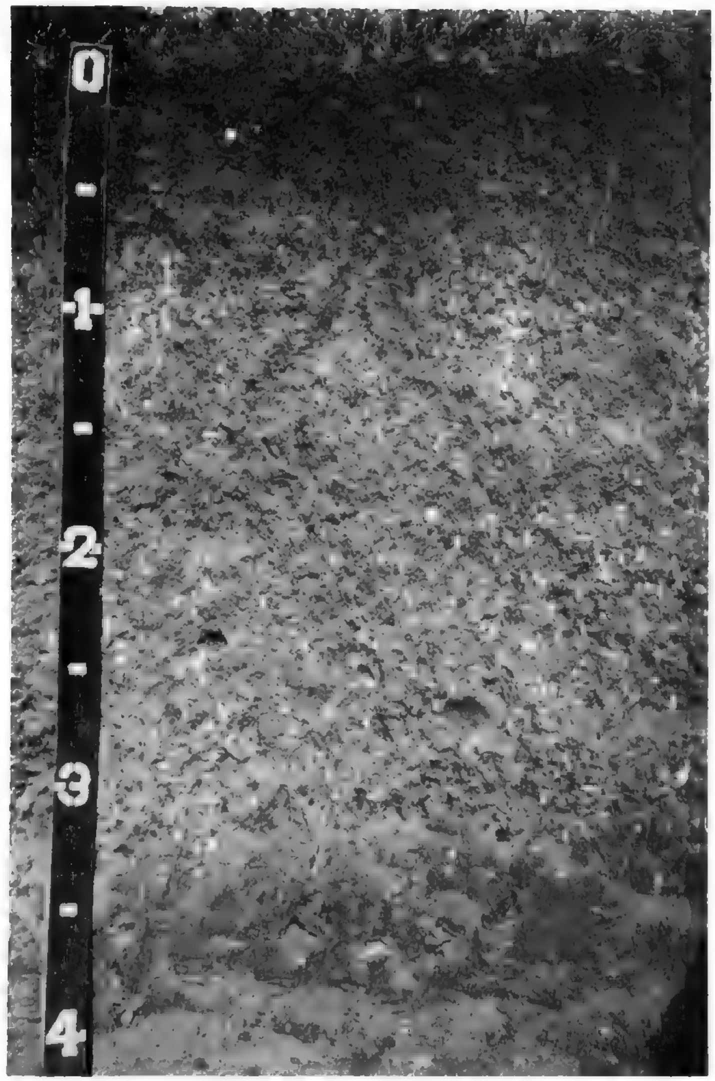

Figure 11.—**A profile of Shindler clay loam, 25 to 40 percent slopes.**

Available water capacity is high. Runoff is medium or rapid.

Many areas are cultivated. Some of the steeper Shindler soils are in native vegetation and are used for pasture, wildlife habitat, and recreation.

Representative profile of Shindler clay loam, 25 to 40 percent slopes, in a pasture, 192 feet west and 159 feet south of the northeast corner of sec. 27, T. 97 N., R. 48 W.:

A1—0 to 7 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable, slightly sticky; neutral; clear, wavy boundary.

B2—7 to 11 inches, dark-gray (10YR 4/1) and grayish-brown (2.5Y 5/2) clay loam, black (10YR 2/1) and very dark grayish brown (2.5Y 3/2) when moist, crushes to very dark grayish brown (2.5Y 3/2); weak, coarse, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; many wormcasts; many fine root channels and pores; slight effervescence; mildly alkaline; clear, wavy boundary.

B3ca—11 to 17 inches, light olive-brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) when moist; weak, coarse and very coarse, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, firm, sticky and plastic; common wormcasts; few fine segregations of lime; strong effervescence; mildly alkaline; gradual, wavy boundary.

C1ca—17 to 35 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) when moist; few, fine, distinct mottles of strong brown (7.5YR 5/6) when moist; weak, coarse, subangular blocky structure parting to moderate, medium and fine, subangular blocky; hard, firm, sticky and plastic; few wormcasts; few fine iron accumulations; few fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—35 to 60 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/4) when moist; common, fine and medium, distinct mottles of strong brown (7.5YR 5/6) and common, fine, distinct mottles of olive gray (5Y 5/2) when moist; massive; hard, firm, sticky and plastic; common fine iron accumulations; few fine and medium segregations of lime; strong effervescence; moderately alkaline.

Depth to free carbonates commonly ranges from 6 to 8 inches, but carbonates are at the surface in some cultivated areas. The A horizon commonly ranges from very dark gray to dark grayish brown, but in eroded areas it is grayish brown. This horizon is clay loam or loam that ranges from 6 to 8 inches in thickness. The B2 horizon ranges from dark grayish brown to brown in hue of 10YR or 2.5Y. It ranges from 3 to 6 inches in thickness. The B3ca horizon ranges from 5 to 10 inches in thickness. Few to common segregations of lime are in the B3ca and C1ca horizons. Small pockets of sand are at a depth of more than 40 inches in some places.

Shindler soils are mapped with Egan, Renner, and Steinauer soils. They have a thinner B horizon and contain less silt than Egan soils. They have thinner A and B horizons than Renner soils. They have a thicker A horizon than Steinauer soils.

Shindler clay loam, 9 to 15 percent slopes (ShD).—This strongly sloping to rolling soil is commonly on the sides of large drainageways.

Included with this soil in mapping are small areas of Crofton, Nora, and Renner soils. Crofton and Nora soils are on the higher parts of the landscape on well-rounded ridges and knolls. Renner soils are in swales and on fans on the lower parts of the landscape along drainageways. These included soils make up 10 to 20 percent of the mapped areas.

Runoff is rapid, and the hazard of erosion is very severe.

This soil is too erodible to be cultivated. Some of the areas are cultivated, but the soil is better suited to pasture and hay than to other uses. Capability unit VIe–3; pasture group G; windbreak group 10.

Shindler clay loam, 25 to 40 percent slopes (ShF).—This steep soil is on the sides of the valleys of large streams and on the sides of deeply entrenched drainageways. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Crofton, Nora, Renner, and Steinauer soils. Crofton and Nora soils are on the higher parts of the landscape on well-rounded ridges. Renner soils are on the lower parts of the landscape along drainageways. Steinauer soils are on the upper sides and tops of ridges. These included soils make up less than 10 percent of the mapped areas.

Runoff is rapid, and the hazard of erosion is very severe.

This soil is too erodible to be cultivated. All areas remain in native grass and are used for pasture. A few native trees are in some areas. Capability unit VIIe–1; windbreak group 10; not assigned to a pasture group.

Shindler-Egan complex, 9 to 15 percent slopes, eroded (SkD2).—The rolling soils in this complex are on the valley sides of streams and large drainageways. This complex is about 55 percent Shindler soil, 30 percent Egan soil, and 15 percent other soil. Areas are long and narrow and are as much as 200 acres in size.

Many areas of these soils are moderately eroded to severely eroded. The Shindler soil is on the higher parts of the landscape where the short slopes are commonly steeper and more convex. The surface layer is clay loam. The Egan soil is below areas of the Shindler soil and has a surface layer of silty clay loam. Both soils have a thinner surface layer than the one in the profile described as representative of their respective series. Also, in eroded areas the surface layer of the Shindler soil is grayish brown because plowing has mixed the surface layer and subsoil.

Included with these soils in mapping are small areas of Alcester and Steinauer soils. Alcester soils are on the lower parts of the landscape. Steinauer soils are on some of the ridges and commonly are severely eroded. Also included are some areas of a soil that is similar to the Egan soil but has a surface layer and subsoil of clay loam. Small gravelly or stony spots are included in some areas, and they are identified on the detailed soil map by spot symbols.

Runoff is rapid in much of the area, and the hazard of erosion is very severe. Erosion has reduced fertility and organic-matter content. Controlling erosion is the main concern of management.

These soils are better suited to grasses and legumes than to other uses. Capability unit VIe–3; windbreak group 10; Shindler soil in pasture group G and Egan soil in pasture group F.

Shindler-Renner complex, 15 to 40 percent slopes (SmF).—This hilly to steep complex is about 55 percent Shindler soil, 35 percent Renner soil, and 10 percent other soil. Areas are as much as 600 acres in size.

The Shindler soil is on the higher parts of the landscape. Its surface layer is clay loam. The Shindler soil has a profile similar to the one described as representative of the Shindler series, but there is a thin layer of forest litter on the surface. The Renner soil is on the middle parts of the landscape on steplike benches and on the lower parts of the landscape on fans and along drainageways. It has a surface layer of loam. The Renner soil has the profile described as representative of the Renner series.

Included with these soils in mapping are small areas of Crofton, Nora, and Steinauer soils. Crofton and Nora soils are on the higher parts of the landscape on well-rounded ridges. Steinauer soils are on the upper sides of steep ridges. Also included are some areas of a soil that is similar to the Renner soil but has a thin subsurface layer of gray loam.

Runoff is medium or rapid. The hazard of erosion is very severe on the Shindler soil. Controlling water erosion is the main concern of management.

All areas of these soils are in native deciduous trees and grass. These woodland areas are used for recreation, wildlife habitat, and pasture. Some of the trees are cut for posts, poles, and fuelwood, and occasionally, for saw logs. Capability unit VIIe-1; windbreak group 10; not assigned to a pasture group.

Shindler and Talmo soils, 6 to 30 percent slopes (StD).—These sloping to steep soils are on terrace escarpments and river breaks. Areas are long and narrow and range from 5 to 80 acres in size. Slopes are short and commonly are more than 15 percent. Some areas are mostly Shindler soil, some are mostly Talmo soil, and others contain both soils in proportions that differ from one area to another. In areas that contain both soils, the Talmo soil is on rounded knobs or ridges in the upper part of the landscape. The soils in this unit have a surface layer of loam and gravelly loam.

Included with these soils in mapping are small areas of Renner and Steinauer soils. Renner soils are on the lower part of some areas. Steinauer soils are on the upper sides of some ridges and escarpments, and in places they are very stony.

Runoff is slow on the Talmo soil and medium or rapid on the Shindler soil. The Talmo soil has low or very low available water capacity and is droughty. Controlling water erosion and soil blowing and conserving moisture are the main concerns of management.

Most areas of these soils are in native grass and are used for grazing. Areas of Talmo soil are a source of sand and gravel for construction uses. Windbreak group 10; Shindler soil in capability unit VIe-3 and pasture group G; Talmo soil in capability unit VIIs-2, not assigned to a pasture group.

Steinauer Series

The Steinauer series consists of deep, well-drained, steep, calcareous, loamy soils on uplands. These soils formed in glacial till. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark-gray, calcareous clay loam about 5 inches thick. Below this is a transition layer of grayish-brown, calcareous clay loam about 5 inches thick. It is slightly hard when dry and friable when moist. The underlying material is light brownish-gray, calcareous clay loam.

Organic-matter content and fertility are low. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. Available water capacity is high. Runoff is rapid.

Most areas are in native grass and are used for pasture. Slopes are too steep for the safe operation of farm machinery.

Representative profile of Steinauer clay loam in an area of Steinauer-Shindler clay loams, 25 to 40 percent slopes, in a pasture, 180 feet west and 410 feet north of the southeast corner of sec. 12, T. 99 N., R. 49 W.:

A1—0 to 5 inches, dark-gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, friable; strong effervescence; mildly alkaline; clear, wavy boundary.

AC—5 to 10 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse and medium, subangular blocky structure parting to weak, fine, subangular blocky; slightly hard, friable; common wormcasts; strong effervescence; moderately alkaline; clear, wavy boundary.

C1ca—10 to 24 inches, light brownish-gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) when moist; weak, coarse and medium, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few wormcasts; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2ca—24 to 43 inches, light brownish-gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) when moist; few, medium, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) when moist; weak, coarse and medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine iron-manganese concretions; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C3—43 to 60 inches, light brownish-gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) when moist; common, medium and coarse, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) and common, fine, distinct mottles of very dark brown (10YR 2/2) when moist; massive; hard, firm, slightly sticky and slightly plastic; common fine iron-manganese concretions; few medium segregations of lime; strong effervescence; moderately alkaline.

The content of clay between depths of 10 and 40 inches commonly is 27 to 30 percent, but it is as much as 35 percent in some places. The A horizon ranges from 3 to 6 inches in thickness. In places there is no AC horizon.

Steinauer soils in Lincoln County are less plastic, have lower bulk density, and contain slightly less clay than is typical for the Steinauer series, but this difference does not alter the usefulness and behavior of the soils.

Steinauer soils are similar to Crofton soils, are near Egan soils, and are mapped with Shindler soils. They contain more sand and less silt than Crofton soils. They do not have the B horizon that is characteristic of Egan and Shindler soils, and they have a thinner A horizon than those soils.

Steinauer-Shindler clay loams, 24 to 40 percent slopes (SuF).—The steep soils in this complex are on breaks along the major streams. This complex is about 50 percent Steinauer soil and 50 percent Shindler soil. Areas are long and narrow and are as much as 160 acres in size. Slopes are mostly 24 to 40 percent, but some are less than 24 percent.

The Steinauer soil is on the higher parts of the landscape and has short, convex slopes. The Shindler soil is below areas of Steinauer soils.

Included with these soils in mapping are small areas of Renner soils on the lower parts of the landscape. Small gravelly and stony spots are included in some areas, and they are identified on the detailed soil map by spot symbols.

Runoff is rapid, and the hazard of erosion is very severe. The Steinauer soil has low fertility and organic-matter content. Controlling erosion is the main concern of management.

Almost all areas of these soils are in native grass and are used for pasture. A few small areas are seeded to tame grass. Capability unit VIIe-1; windbreak group 10; not assigned to a pasture group.

Talmo Series

The Talmo series consists of excessively drained, gently undulating to hilly, loamy soils that are very shallow over sand and gravel. These soils formed in outwash sand and gravel. They are on high terraces and terrace fronts. The native vegetation was mainly mid and short grasses.

In a representative profile the surface layer is very dark gray and dark grayish-brown, calcareous gravelly loam about 8 inches thick. The underlying material is yellowish-brown, calcareous sand and gravel.

Organic-matter content and fertility are low. Permeability is rapid, and available water capacity is low or very low. Runoff is slow.

Most areas are in native vegetation and are used for pasture. Others are in tame grasses. These soils are too droughty for cultivated crops.

Talmo soils in Lincoln County are mapped only with Delmont and Shindler soils.

Representative profile of Talmo gravelly loam in an area of Delmont and Talmo soils, 2 to 9 percent slopes, in a pasture, 90 feet west and 434 feet north of the southeast corner of sec. 24, T. 96 N., R. 48 W.:

A11—0 to 5 inches, very dark gray (10YR 3/1) gravelly loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, fine, granular structure; soft, very friable; strong effervescence; mildly alkaline; clear, smooth boundary.

A12—5 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable; strong effervescence; moderately alkaline; clear, wavy boundary.

IIC—8 to 60 inches, yellowish-brown (10YR 5/4) sand and gravel, dark yellowish brown (10YR 4/4) when moist; single grained; loose; strong effervescence; moderately alkaline.

Sand and gravel are at a depth of 10 inches or less. Depth to free carbonates ranges from 0 to 10 inches. The A horizon is gravelly loam or loam that ranges from 6 to 9 inches in thickness. In places there is a thin AC horizon.

Talmo soils are mapped with Delmont soils and are near Dempster and Graceville soils. They are shallower over sand and gravel than those soils.

Tetonka Series

The Tetonka series consists of deep, poorly drained, level, silty soils that have a clayey subsoil. These soils are in depressions in the uplands. They formed in alluvium that washed from adjacent soils. The native vegetation was mainly tall grasses and sedges.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 11 inches thick. The subsurface layer is gray silt loam about 8 inches thick. The subsoil, about 22 inches thick, is dark-gray silty clay. It is extremely hard when dry, very firm when moist, and sticky and plastic when wet. The lower part of the subsoil is calcareous. The underlying material is light olive-gray, calcareous clay.

Organic-matter content and fertility are high. Permeability is very slow, and available water capacity is high. Runoff is ponded. In most areas a seasonal high water table is at a depth of 2 to 8 feet.

Many areas are cultivated. Undrained areas are better suited to pasture and wildlife habitat than to other uses.

Representative profile of Tetonka silty clay loam, in a cultivated area, 1,880 feet east and 182 feet north of the southwest corner of sec. 34, T. 98 N., R. 50 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silty clay loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, fine, granular structure; slightly hard, friable, slightly sticky; neutral; abrupt, smooth boundary.

A12—7 to 11 inches, dark grayish-brown (10YR 4/2) silty clay loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky; neutral; clear, smooth boundary.

A2—11 to 19 inches, gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) when moist; common, fine, distinct mottles of dark brown (10YR 4/3) when moist; weak, thin, platy structure; soft, friable; many fine pores; neutral; clear, wavy boundary.

B2t—19 to 36 inches, dark-gray (5Y 4/1) silty clay, black (5Y 2/1) when moist; few tongues of dark gray (5Y 4/1) when moist; moderate, medium, prismatic structure parting to moderate, medium and fine, blocky; extremely hard, very firm, sticky and plastic; distinct shiny coatings on vertical faces of peds; neutral; clear, wavy boundary.

B3cs—36 to 41 inches, dark-gray (5Y 4/1) silty clay, black (5Y 2/1) when moist; few, fine, faint mottles of olive gray when moist; weak, coarse, prismatic structure parting to moderate, medium and fine, subangular blocky; extremely hard, very firm, sticky and plastic; distinct shiny coatings on vertical faces of peds; many medium nests of gypsum crystals; few fine segregations of lime; slight effervescence; mildly alkaline; clear, wavy boundary.

C1ca—41 to 53 inches, light olive-gray (5Y 6/2) clay loam, olive (5Y 5/3) when moist; common, fine, faint mottles of dark gray, common, fine, distinct mottles of black (5Y 2/1), many, fine, faint mottles of very dark brown, and many, medium, distinct mottles of light olive brown (2.5Y 5/6) when moist; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; common fine manganese concretions; many fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2ca—53 to 60 inches, light olive-gray (5Y 6/2) clay loam, olive gray (5Y 5/2) when moist; common, medium, faint mottles of olive (5Y 5/3) and gray (5Y 5/1), common, fine, distinct mottles of very dark brown (10YR 2/2), and many, fine, faint mottles of light olive brown when moist; weak, coarse, subangular blocky structure; very hard, firm, sticky and plastic; few fine manganese concretions; common fine segregations of lime; strong effervescence; moderately alkaline.

Depth to lime ranges from 30 to 60 inches or more. The A1 horizon commonly is silty clay loam, but it is silt loam in

A2 horizon is silt loam or silty clay loam that ranges from some places. It ranges from 8 to 15 inches in thickness. The 4 to 10 inches in thickness. The B2t horizon is silty clay or heavy silty clay loam that ranges from 14 to 30 inches in thickness. The B3 horizon is silty clay, silty clay loam, or clay loam that ranges from 4 to 10 inches in thickness. The C horizon is silty clay, silty clay loam, or clay loam.

Tetonka soils are mapped with Chancellor soils and are near Viborg soils. They are in depressions, as are Worthing soils. They are more poorly drained than Chancellor and Viborg soils. They differ from Chancellor, Viborg, and Worthing soils in having an A2 horizon.

Tetonka silty clay loam (0 to 1 percent slopes) (Te).—This level soil is in closed depressions in the uplands. Areas are circular in shape and range from 2 to 20 acres in size.

Included with this soil in mapping are small areas of Wakonda soils that form a narrow rim around the depressions. Also included are some areas of a soil that is similar to this Tetonka soil but has a thicker surface layer.

Runoff from adjacent soils ponds on this soil (fig. 12). If the soil is cultivated when wet, it loses its tilth. Wetness and maintaining tilth are the main concerns of management.

If drainage is adequate, the soil is suited to all crops commonly grown in the county. Undrained areas are better suited to late-planted crops or to pasture, hay, or wildlife habitat than to other uses. Capability unit IIw-1 if drained and IVw-2 if not drained; pasture group A if drained and B if not drained; windbreak group 10.

Thurman Series

The Thurman series consists of deep, somewhat excessively drained, gently undulating to undulating, loamy soils on uplands and terrace fronts. These soils formed in sand that has been reworked by wind. The native vegetation was tall and mid grasses.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 12 inches thick. Below this is a transition layer of brown loamy fine sand about 5 inches thick. It is soft when dry and very friable when moist. The underlying material is pale-brown loamy fine sand to a depth of 44 inches and pale-brown, calcareous fine sand below a depth of 44 inches.

Organic-matter content is moderately low, and fertility is medium. Permeability is rapid, and available water capacity is low or moderate. Runoff is slow.

Some areas are cultivated. These soils are better suited to grasses and legumes than to other crops.

Representative profile of Thurman fine sandy loam, 2 to 6 percent slopes, in a cultivated area:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

A12—9 to 12 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse and medium, subangular blocky structure; slightly hard, very friable; neutral; clear, wavy boundary.

Figure 12.—Water ponds on Tetonka silty clay loam, which is in the center of field. Well-drained soil in foreground is Wentworth silty clay loam, 0 to 2 percent slopes.

AC—12 to 17 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) when moist; few coatings of very dark grayish brown along root channels when moist; weak, very coarse, subangular blocky structure; soft, very friable; neutral; clear, wavy boundary.

C1—17 to 44 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) when moist; weak, very coarse, subangular blocky structure; loose; neutral; clear, wavy boundary.

C2—44 to 60 inches, pale-brown (10YR 6/3) fine sand, dark brown (10YR 4/3) when moist; single grained; loose; few fine concretions of lime; strong effervescence; mildly alkaline.

Depth to lime ranges from 30 to 60 inches or more. The A horizon ranges from very dark gray to dark grayish brown. It is fine sandy loam or loamy fine sand that ranges from 10 to 18 inches in thickness. In places there is no AC horizon. The C horizon between depths of 40 and 60 inches is silty clay loam, clay loam, or loam in some places.

Thurman soils are near Delmont, Dempster, Egan, Shindler, and Wentworth soils. They do not have the gravelly C horizon that is characteristic of Delmont and Dempster soils. They contain more sand than Egan, Shindler, and Wentworth soils.

Thurman fine sandy loam, 2 to 6 percent slopes (ThB).—This gently undulating soil is in irregularly shaped areas that range from 5 to 105 acres in size. Slopes are mostly 2 to 6 percent, but in some small areas slopes are less than 2 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of a soil that is similar to this Thurman soil, but the underlying material is silty clay loam or clay loam at a depth of 30 to 40 inches.

Runoff is slow. This soil absorbs water readily, but it has low or moderate available water capacity. Controlling soil blowing and conserving moisture are the main concerns of management.

Some areas are cultivated. The soil is better suited to small grain, grasses, and legumes than to row crops. Capability unit IIIe–7; pasture group H; windbreak group 5.

Thurman fine sandy loam, 6 to 9 percent slopes (ThC).—This undulating soil is in long, narrow areas that range from 5 to 80 acres in size. It has a profile similar to the one described as representative of the series, but the surface layer is slightly thinner.

Included with this soil in mapping are small areas of a soil that is similar to this Thurman soil, but the underlying material is silty clay loam or clay loam at a depth of 30 to 40 inches.

Runoff is slow. This soil blows easily and is droughty. Cultivated areas also are subject to water erosion. Controlling soil blowing and water erosion and conserving moisture are the main concerns of management.

Some areas are cultivated, but this soil is better suited to pasture and hay plants because of the hazards of soil blowing and droughtiness. Capability unit IVe–3; pasture group H; windbreak group 5.

Viborg Series

The Viborg series consists of deep, moderately well drained, nearly level, silty soils on uplands in swales and slight depressions. These soils formed in silty material and in the underlying glacial till. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark-gray silty clay loam about 17 inches thick. The subsoil, about 17 inches thick, is grayish-brown silty clay loam. The upper part is slightly hard when dry, friable when moist, and slightly sticky and slightly plastic when wet. The lower part is calcareous. The underlying material is light yellowish-brown, calcareous clay loam.

Organic-matter content and fertility are high. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is slow. These soils commonly receive runoff from adjacent soils.

Most areas are cultivated. Corn, soybeans, oats, and alfalfa are the main crops.

Viborg soils in Lincoln County are mapped only with Chancellor soils.

Representative profile of Viborg silty clay loam in a cultivated area of Chancellor-Viborg silty clay loams, 168 feet north and 660 feet east of the southwest corner of sec. 2, T. 99 N., R. 49 W.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak, coarse and medium, subangular blocky structure; slightly hard, friable, slightly sticky; slightly acid; abrupt, smooth boundary.

A12—7 to 17 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak, coarse and medium, subangular blocky structure parting to weak, fine, granular; slightly hard, friable, slightly sticky; slightly acid; gradual, wavy boundary.

B21—17 to 23 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, coarse and medium, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; gradual, wavy boundary.

B22—23 to 30 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable, slightly sticky; few wormcasts; neutral; clear, wavy boundary.

B3ca—30 to 34 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; few, fine, distinct mottles of olive gray (5Y 5/2) and light olive brown (2.5Y 5/6) when moist; weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; hard, friable, slightly sticky; few fine iron concretions; common fine segregations of lime; strong effervescence; moderately alkaline; clear, wavy boundary.

IIC1ca—34 to 45 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) when moist; common, fine and medium, distinct mottles of olive gray (5Y 5/2), common, fine, distinct mottles of light olive brown (2.5Y 5/6) and very dark brown (10YR 2/2), and few, fine, distinct mottles of strong brown (7.5YR 5/6) when moist; weak, coarse and medium, subangular blocky structure; hard, firm, slightly sticky; few fine iron concretions; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

IIC2—45 to 60 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) when moist; common, medium and coarse, distinct mottles of olive gray (5Y 5/2), common, fine and medium, distinct mottles of strong brown (7.5YR 5/6), and common, fine, distinct mottles of light olive brown (2.5Y 5/6) and very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure; hard, friable, slightly sticky;

common fine and medium iron concretions; few fine segregations of lime; strong effervescence; moderately alkaline.

Thickness of the silty material over firm glacial till or drift ranges from 30 to 40 inches. Depth to lime ranges from 22 to 36 inches. The A horizon ranges from very dark gray to dark grayish brown. It is silty clay loam or silt loam that ranges from 8 to 18 inches in thickness. The B2 horizon ranges from dark grayish brown to light olive brown and from 10 to 15 inches in thickness. In places there is no B3 horizon, but where present it ranges to as much as 10 inches in thickness. The IIC horizon is clay loam or loam, but in places it contains thin layers of silty clay loam or silt loam.

Viborg soils are mapped with Chancellor soils and are near Egan and Wentworth soils. They are better drained and contain less clay in the B horizon than Chancellor soils. They are not so well drained as Egan and Wentworth soils, and they have a thicker A horizon than those soils.

Wakonda Series

The Wakonda series consists of deep, moderately well drained, nearly level, calcareous, silty soils on uplands. These soils formed in silty glacial drift. The native vegetation was mainly tall grasses.

In a representative profile the surface layer is dark-gray, calcareous silt loam about 10 inches thick. Below this is a layer of light brownish-gray, calcareous silt loam about 21 inches thick. The upper part is slightly hard when dry, friable when moist, and slightly sticky when wet. The lower part is mottled with gray and yellowish brown and contains spots and streaks of soft lime. The underlying material is light yellowish-brown, calcareous silty clay loam.

Organic-matter content is moderate, and fertility is medium. Permeability is moderate, and available water capacity is moderate or high. Runoff is slow. These soils have a seasonal high water table at a depth of 3 to 5 feet.

Most areas are cultivated. Corn, soybeans, oats, and alfalfa are the main crops.

Wakonda soils in Lincoln County are mapped only with Chancellor and Tetonka soils.

Representative profile of Wakonda silt loam in a cultivated area of Chancellor-Wakonda-Tetonka complex, in a cultivated area, 147 feet north and 531 feet east of the southwest corner of sec. 34, T. 98 N., R. 50 W.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) silt loam that crushes to dark grayish brown (10YR 4/2), black (10YR 2/1) when moist; weak, fine, granular structure; hard, friable; common wormcasts; slight effervescence; mildly alkaline; abrupt, smooth boundary.

A12—6 to 10 inches, dark-gray (10YR 4/1) silt loam that crushes to dark grayish brown (10YR 4/2), black (10YR 2/1) when moist; weak, medium, subangular blocky structure parting to weak, fine, granular; slightly hard, friable; few wormcasts; strong effervescence; mildly alkaline; clear, wavy boundary.

C1ca—10 to 20 inches, light brownish-gray (2.5Y 6/2) silt loam, very dark grayish brown (2.5Y 3/2) when moist, crushes to olive brown (2.5Y 4/3); weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable, slightly sticky; few wormcasts; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2ca—20 to 31 inches, light brownish-gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/3) when moist; common, fine, distinct mottles of gray (5Y 5/1) and few, fine, faint mottles of yellowish brown when moist; weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; hard, friable, slightly sticky; few fine iron concretions; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C3gcs—31 to 43 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/4) when moist; common, fine and medium, distinct mottles of gray (5Y 5/1) and strong brown (7.5YR 5/6) when moist; massive; hard, friable, slightly sticky; common fine iron concretions and few fine manganese concretions; common medium segregations of gypsum; few fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C4g—43 to 60 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/4) when moist; common, medium, distinct mottles of gray (5Y 5/1) and strong brown (7.5YR 5/6) when moist; massive; hard, firm, slightly sticky and slightly plastic; common fine iron and manganese concretions; few medium segregations of gypsum; slight effervescence; mildly alkaline.

Electrical conductivity of the saturation extract ranges from 1 to 5 in the A horizon and from 4 to 10 in the C horizon. The calcium carbonate equivalent ranges from 1 to 8 in the A horizon and from 16 to 30 percent in the Cca horizon. The A horizon ranges from very dark gray to grayish brown. It is silt loam or silty clay loam that ranges from 7 to 12 inches in thickness. Few to many segregations of lime and gypsum are in the C horizon. Visible salts other than gypsum are in the C horizon in places. In places there is a IIC horizon of clay loam or loam glacial till at a depth of 40 to 60 inches.

Wakonda soils are mapped with Chancellor soils and are near Worthing, Egan, Wentworth, and Viborg soils. They are more calcareous in the upper part of the profile than those soils. Also, they contain less clay than Chancellor and Worthing soils and are more poorly drained than Egan and Wentworth soils.

Wentworth Series

The Wentworth series consists of deep, well-drained, nearly level, silty soils on uplands. These soils formed in silty glacial drift. The native vegetation was mainly tall and mid grasses.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 7 inches thick. The subsoil is silty clay loam about 27 inches thick. It is dark brown in the upper part, yellowish brown in the middle part, and light yellowish brown in the lower part. It is slightly hard when dry, friable when moist, and slightly sticky when wet. The lower part is calcareous and has spots and streaks of soft lime that extend into the underlying material. The underlying material is light yellowish-brown, calcareous silty clay loam.

Organic-matter content and fertility are high. Permeability is moderate, and available water capacity is high. Runoff is slow.

Most areas are cultivated. Corn, oats, soybeans, and alfalfa are the main crops.

Representative profile of Wentworth silty clay loam, 0 to 2 percent slopes, in a cultivated area, 78 feet north and 432 feet west of the southeast corner of sec. 5, T. 98 N., R. 49 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silty

clay loam, black (10YR 2/1) when moist, crushes to very dark brown (10YR 2/2); weak, fine, granular structure; slightly hard, friable, slightly sticky; neutral; abrupt, smooth boundary.

B21—7 to 13 inches, dark-brown (10YR 4/3) silty clay loam, very dark grayish brown (10YR 3/2) when moist, crushes to dark brown (10YR 3/3); weak, coarse and medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable, slightly sticky; few wormcasts; neutral; gradual, wavy boundary.

B22—13 to 25 inches, yellowish-brown (10YR 5/4) silty clay loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; slightly hard, friable, slightly sticky; few wormcasts; neutral; clear, wavy boundary.

B3ca—25 to 34 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, olive brown (2.5Y 4/3) when moist; few, fine, distinct mottles of olive gray (5Y 5/2) and yellowish brown (10YR 5/6) when moist; weak, coarse and medium, prismatic structure parting to weak, coarse and medium, subangular blocky; slightly hard, friable, slightly sticky; few fine iron concretions; many fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C1ca—34 to 43 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) when moist; common, fine and medium, distinct mottles of olive gray (5Y 5/2) and yellowish brown (10YR 5/6) when moist; weak, coarse and medium, subangular blocky structure; hard, friable, slightly sticky; common fine and medium iron concretions; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—43 to 54 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) when moist; few, fine and medium, distinct mottles of olive gray (5Y 5/2) and common, fine and medium, distinct mottles of strong brown (7.5YR 5/6) when moist; weak, coarse and medium, subangular blocky structure; hard, friable, slightly sticky; common fine and medium iron concretions; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C3—54 to 60 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) when moist; many, medium, distinct mottles of olive gray (5Y 5/2) and many, medium and coarse, distinct mottles of strong brown (7.5YR 5/6) when moist; weak, coarse and medium, subangular blocky structure; hard, friable, slightly sticky; common fine iron concretions; few coarse fragments of chalk; few fine segregations of lime; strong effervescence; moderately alkaline.

Depth to free carbonates ranges from 18 to 32 inches. The A horizon ranges from very dark gray to dark grayish brown and from 5 to 10 inches in thickness. The B2 horizon has hue of 10YR or 2.5Y and ranges from dark grayish brown to light olive brown in the upper part and from brown to light yellowish brown in the lower part. This horizon ranges from 11 to 22 inches in thickness. The B3ca horizon ranges from 4 to 10 inches in thickness. The C horizon is silty clay loam or silt loam and commonly is thinly stratified with loam, very fine sandy loam, or sandy loam. Clay loam or loam glacial till is between depths of 40 and 60 inches in places.

Wentworth soils are mapped with Chancellor soils and are near Egan and Viborg soils. Their profile is similar to that of Moody soils. They have a less clayey B horizon and are better drained than Chancellor soils. They have a silty C horizon to a greater depth than Egan soils. They are more shallow to lime and have a more stratified C horizon than Moody soils. They have a thinner A horizon and are better drained than Viborg soils.

Wentworth silty clay loam, 0 to 2 percent slopes (WeA).—This nearly level soil is on smooth uplands. Areas are mostly less than 100 acres in size. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Egan and Viborg soils. Egan soils are on slight rises. Viborg soils are in shallow swales. Small wet spots are included in some areas, and they are identified on the detailed soil map by spot symbols. These included soils make up about 20 percent of the mapped areas.

Runoff is slow. Fertility is high. The soil has slight or no limitations to use for crops. Maintaining fertility is the main concern of management.

Almost all areas are cultivated. The soil is well suited to all crops commonly grown in the county. Capability unit I–2; pasture group F; windbreak group 3.

Wentworth-Chancellor silty clay loams, 0 to 2 percent slopes (WhA).—The nearly level soils in this complex are on a series of very slight rises and in shallow swales, some of which contain small, circular depressions. This complex is about 55 percent Wentworth soil, 25 percent Chancellor soil, and 20 percent other soil. Areas are as much as 1,200 acres in size. The Wentworth soil is on the rises, and the Chancellor soil is in the swales.

Included with these soils in mapping are areas of Egan, Tetonka, Viborg, and Wakonda soils. Egan soils are the most extensive and are on the rises with Wentworth soils. Tetonka soils are in small depressions. Viborg soils are in some of the swales. Wakonda soils are on the rims of the depressions or the edges of the swales.

Runoff is slow, and water collects on the Chancellor soil. Spring planting commonly is delayed by wetness on the Chancellor soil. The Wentworth soil has only slight limitations to use for crops. Wetness and maintaining tilth on the Chancellor soil are the main concerns of management.

Most areas of these soils are cultivated. The soils are well suited to all crops commonly grown in the county. During wet years, late-planted crops are better suited than others. Capability unit I–2; Wentworth soil in pasture group F and windbreak group 3; Chancellor soil in pasture group A and windbreak group 2.

Worthing Series

The Worthing series consists of deep, poorly drained to very poorly drained, level, clayey soils in depressions in the uplands. These soils formed in alluvium that washed from adjacent soils. The native vegetation was mainly tall grasses, rushes, and sedges.

In a representative profile the surface layer is very dark gray silty clay about 10 inches thick. The subsoil is silty clay about 32 inches thick. It is very dark gray in the upper part and dark gray in the lower part. It is very hard when dry, very firm when moist, and sticky and plastic when wet. The underlying material is dark-gray, calcareous silty clay.

Organic-matter content and fertility are high. Permeability is slow, and available water capacity is moderate or high. Runoff is slow to ponded. These soils have a seasonal high water within 5 feet of the surface.

Where drainage is adequate, these soils are culti-

vated. Undrained areas are used for pasture and wildlife habitat.

Representative profile of Worthing silty clay, in a pasture, 500 feet south and 123 feet east of the northwest corner of sec. 28, T. 98 N., R. 50 W.:

A1—0 to 10 inches, very dark gray (5Y 3/1) silty clay, black (5Y 2/1) when moist; weak, medium and fine, subangular blocky structure; hard, friable, sticky and slightly plastic; neutral; clear, wavy boundary.

B21t—10 to 19 inches, very dark gray (5Y 3/1) silty clay, black (5Y 2/1) when moist; weak, medium, prismatic structure parting to moderate, medium and fine, blocky; very hard, very firm, sticky and plastic; peds have distinct shiny faces; neutral; gradual, wavy boundary.

B22t—19 to 26 inches, dark-gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) when moist; few, medium, faint mottles of very dark grayish brown and olive gray when moist; moderate, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, very firm, sticky and plastic; peds have distinct shiny faces; neutral; gradual, wavy boundary.

B23g—26 to 35 inches, dark-gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) when moist; few, fine and medium, faint mottles of olive gray and few, medium, distinct mottles of olive (5Y 4/3) when moist; moderate, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, very firm, sticky and plastic; neutral; gradual, wavy boundary.

B3g—35 to 42 inches, dark-gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) when moist; few, fine and medium, faint mottles of olive gray, few, medium, distinct mottles of olive (5Y 4/3), and few, fine, faint mottles of gray when moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; very hard, very firm, sticky and plastic; neutral; clear, wavy boundary.

Cgca—42 to 60 inches, dark-gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) when moist; common, fine, faint mottles of olive gray and common, fine, distinct mottles of olive (5Y 4/3, 5/6) when moist; massive; very hard, very firm, sticky and plastic; few fine iron concretions; common fine concretions of lime; strong effervescence; mildly alkaline.

Depth to free carbonates ranges from 38 to 60 inches. The A horizon is very dark gray or dark gray. It is silty clay or silty clay loam that ranges from 8 to 20 inches in thickness. The B2t horizon ranges from very dark gray to gray and from 25 to 35 inches in thickness. The B3g and Cg horizons commonly are silty clay, clay, or silty clay loam, but in places they are clay loam below a depth of 40 inches.

Worthing soils are near Chancellor soils and are in depressions, as are Tetonka soils. They are more poorly drained than Chancellor soils. They do not have the A2 horizon that is characteristic of Tetonka soils.

Worthing silty clay (0 to 1 percent slopes) (Ws).—This level soil is in closed depressions in the uplands. Areas commonly are circular in shape and range from 5 to 85 acres in size. The soil has the profile described as representative of the series, but in some places the depth to lime is less and the subsoil is olive brown or olive.

Included with this soil in mapping are small areas of Wakonda soils on the edges of the depressions.

Runoff from adjacent soils ponds on this soil, and the soil remains wet for long periods. If the soil is farmed when wet, it compacts and is very hard and cloddy upon drying. Wetness and maintaining tilth are the main concerns of management.

Many areas are cultivated. If the soil is adequately drained, it is suited to all crops commonly grown in the county. During wet years, late-planted crops are better suited than others. Undrained areas are better suited to pasture, hay, and wildlife habitat than to other uses. Capability unit IIIw-1 if drained and Vw-2 if not drained; pasture group A if drained and B if not drained; windbreak group 10.

Use and Management of the Soils

This section describes use and management of the soils for cultivated crops, tame pasture, woodland and windbreaks, wildlife, engineering, and town and country planning.

Crops [2]

About 82 percent of Lincoln County is cultivated. The main crops are corn, oats, soybeans, and alfalfa. Barley, wheat, and tame grasses are also grown.

The successful long-term cultivation of any soil depends on managing that soil according to its capabilities and limitations for crops. The main concerns in managing the soils of this county for crops are controlling water erosion, conserving moisture, and maintaining fertility, organic-matter content, and tilth. Controlling soil blowing, removing stones, reducing salinity, and using drainage measures that reduce excessive wetness also are needed on some soils.

A sound conservation cropping system tailored to the properties of each soil or group of soils is needed. Some soils can be used for a single crop for many years without damaging tilth. The tilth of other soils deteriorates rapidly if the soils are used continuously for one crop, especially if the crop produces little residue. A cropping system based on soil properties helps to maintain tilth; to reduce infestations of insects, diseases, and weeds; and to control water erosion and soil blowing. In most cases such a cropping system also helps to conserve moisture and maintain fertility and organic-matter content.

Conserving moisture generally means evenly distributing snow cover, reducing evaporation, limiting runoff, and controlling weeds. Among the measures that help to conserve moisture are minimum tillage, use of crop residue, contour farming, contour stripcropping, terracing, and timely tillage. These practices also help to control water erosion and soil blowing. Where needed, grassed waterways and diversions also help to control erosion. Usually a combination of practices is more effective than just one or two.

Among the practices that help to maintain tilth are minimum tillage, use of crop residue, timely tillage, green-manure crops, and grasses and legumes in the cropping system. These measures and the use of animal manure and chemical fertilizers help to maintain fertility and organic-matter content.

Some soils are more susceptible than others to soil blowing. On such soils, in addition to the practices named above, the use of cover crops and close-sown

[2] By PAUL M. BODEN, conservation agronomist, Soil Conservation Service.

crops in the cropping system, wind stripcropping, field windbreaks, and spring plowing in place of fall plowing help to control soil blowing. Emergency tillage helps to control soil blowing until more permanent measures can be applied.

Some of the soils on bottom lands and in low areas in the uplands are too wet to be farmed early in the growing season. Installing drainage structures and controlling the runoff from adjacent sloping soils help to reduce the wetness of these soils. Selecting adapted crops also is important on these soils. Onsite investigation is needed to determine the feasibility of draining these soils.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural or other specialty crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These are described in the following paragraphs.

CAPABILITY CLASSES, the broadest group, are designated by Roman numerals I to VIII. The numbers indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture or range, woodland, or wildlife habitat.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral; for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

Class I contains no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management (*8*). Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol; for example, IIe-1 or IIIs-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages the capability units in Lincoln County are described, and suggestions for their use and management are given. The capability units within a capability subclass are not numbered consecutively, because not all of the units in the statewide system are used in this county. Also, if a soil series is part of a soil complex, the capability unit can be different than if a soil series is mapped alone. This is because a complex is treated as a whole in its management for crops. To find the capability classification of a given soil in this county, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I-1

This unit consists of deep, nearly level soils on bottom lands and low terraces. These moderately well drained soils have a surface layer and a subsoil of silty clay loam or loam.

These soils are easy to work and have high fertility. Permeability is moderate. Available water capacity is high, and runoff is slow. Additional water is received as runoff from adjacent slopes or from stream flooding. In most years this additional moisture is beneficial. Limitations for crops are only slight; consequently, the soils can be farmed intensively.

The soils in this unit are used mostly for corn, soy-

beans, small grain, and alfalfa. They also are well suited to tame and native grasses and to other less intensive uses.

Managing crop residue, including grasses and legumes in the cropping system, and applying fertilizer help to maintain fertility and tilth.

CAPABILITY UNIT I-2

This unit consists of deep, nearly level silty soils on uplands. Most of these soils are well drained and have a surface layer and a subsoil of silty clay loam. Some of the soils that occur in a complex, however, are somewhat poorly drained, and they have a subsoil of silty clay.

The dominant soils in this unit are easy to work and have high fertility. Permeability is generally moderate, but it is slow in the somewhat poorly drained soils. Available water capacity is high, and runoff is slow. Soil blowing is a slight hazard. Limitations for crops are only slight; consequently, the soils can be farmed intensively. The somewhat poorly drained soils are wet in spring. Reducing wetness is a concern of management.

All the soils in this unit are well suited to crops, and they are used mainly for corn (fig. 13), soybeans, small grain, and alfalfa. They also are suited to tame and native grass pasture and to other less intensive uses.

Managing crop residue, including grasses and legumes in the cropping system, and applying fertilizer help to maintain fertility and tilth. Leaving areas rough after fall plowing helps to control soil blowing.

CAPABILITY UNIT I-3

Graceville silty clay loam, the only soil in this unit, is a moderately well drained, nearly level soil in swales and on slightly depressed flats on high terraces. It has a surface layer and a subsoil of silty clay loam that are underlain by sand and gravel at a depth of about 47 inches.

This soil has high fertility. Permeability is moderate. Available water capacity is high, and runoff is slow. Many areas receive additional moisture as runoff from adjacent soils. Limitations for crops are few.

All areas of this soil are cultivated and are used mainly for corn, soybeans, small grain, and alfalfa. The soil is suited to tame and native grass pasture and to other less intensive uses.

Managing crop residue, including grasses and legumes in the cropping system, and applying fertilizer help to maintain fertility and tilth.

CAPABILITY UNIT IIe-1

Alcester silty clay loam, 2 to 6 percent slopes, is the only soil in this unit. This is a moderately well drained, gently sloping soil along drainageways. It has a surface layer and a subsoil of silty clay loam.

This soil is easy to work and has high fertility. Permeability is moderate. Available water capacity is high, and runoff is medium. Most areas receive beneficial moisture as runoff from adjacent sloping soils. Controlling water erosion is the main concern of management.

Most areas are cultivated and are used for corn, soybeans, small grain, and alfalfa. The soil in this unit also is suited to sorghum, clover, and tame grasses.

Managing crop residue and farming on the contour help to control water erosion. Gullying can be prevented by constructing grassed waterways.

Figure 13.—**Harvesting corn in an area of Wentworth-Chancellor silty clay loams, 0 to 2 percent slopes.**

CAPABILITY UNIT IIe-3

This unit consists of deep, gently sloping and gently undulating silty and loamy soils on uplands. Most of these soils are well drained and have a surface layer and a subsoil of silty clay loam or clay loam. Some of the soils that occur in a complex, however, are somewhat poorly drained and poorly drained, and they have a subsoil of silty clay.

The dominant soils in this unit are easy to work and have medium or high fertility. Permeability is generally moderate in the subsoil, but it is slow in the somewhat poorly drained and poorly drained soils. Wetness commonly delays spring planting in areas where drainage is poor. Available water capacity is high, and runoff is medium. Controlling water erosion is the main concern of management. Conserving moisture, controlling soil blowing, and maintaining fertility are other management concerns.

Most areas are cultivated and are used for corn, soybeans, small grain, and alfalfa. The soils in this unit also are suited to tame and native grass pasture and to other less intensive uses.

Contour farming and terracing are effective means of controlling water erosion and conserving moisture. If slopes are too irregular for these mechanical practices, managing crop residue and using more close-sown crops help to control water erosion and soil blowing.

CAPABILITY UNIT IIw-1

This unit mostly consists of deep, somewhat poorly drained and poorly drained, nearly level and level soils in swales and depressions in the uplands. These soils have a surface layer of silty clay loam and a subsoil of silty clay. Some of the soils that occur in a complex, however, are deep, moderately well drained, nearly level soils that have a surface layer and a subsoil of silty clay loam or silt loam.

The dominant soils in this unit are difficult to work, but they have high fertility and high available water capacity. Permeability is slow. Planting and tillage operations are delayed by wetness from a seasonal high water table or from ponding, but drainage is adequate in most years. These soils lose their tilth if they are cultivated when wet. Reducing wetness, increasing the intake of water, and maintaining tilth are the main concerns of management. The moderately well drained silt loam soil in this unit is high in content of lime and is subject to soil blowing.

Most areas are cultivated and are used for corn, soybeans, small grain, and alfalfa. Such late-planted crops as corn, soybeans, and sorghum are better suited than others. Survival of alfalfa is affected by wetness and ponding. The soils also are suited to tame and native grass pasture and to other less intensive uses.

Installing a surface or underground drainage system helps to control wetness. Managing crop residue and using minimum tillage and timely tillage help to maintain tilth, increase the intake of water, and control soil blowing. Fall plowing helps to insure a good seedbed in spring.

CAPABILITY UNIT IIw-3

This unit consists of deep, somewhat poorly drained and poorly drained, level and nearly level soils on bottom lands. These soils have a surface layer of silty clay loam. The subsoil or underlying material is silty clay loam or silty clay.

The soils in this unit are difficult to work. If the soils are worked when wet, they compact and lose their tilth. Fertility is high. Permeability is slow or moderately slow. Available water capacity is high. Wetness from flooding and from a seasonal high water table commonly delays planting and tillage operations, but an installed drainage system allows the soils to be used for crops in most years. Reducing wetness, maintaining tilth, and increasing the intake of water are the main concerns of management.

Drained areas of these soils are suited to corn, soybeans, small grain, sorghum, alfalfa, and tame grasses.

If outlets are available, the water table can be lowered by installing underground drains. Damage from flooding can be reduced by constructing dikes, floodwater diversions, or floodways to remove excess water. Managing crop residue and using minimum tillage and timely tillage help to maintain tilth and increase the intake of water.

CAPABILITY UNIT IIs-2

Huntimer silty clay loam, 0 to 2 percent slopes, is the only soil in this unit. This is a deep, well-drained, nearly level soil on uplands. It has a surface layer of silty clay loam and a subsoil of silty clay.

This soil has high fertility. Available water capacity is high, but the clayey subsoil takes in water slowly and limits the growth of plant roots. Runoff is slow, and the soil dries slowly. Planting is delayed during wet years. Maintaining tilth and increasing the intake of water are the main concerns of management.

Most areas are cultivated and are used for corn, soybeans, oats, and alfalfa. The soil also is suited to tame and native grass pasture and to other less intensive uses.

Managing crop residue, including grasses and legumes in the cropping system, and using minimum tillage and timely tillage help to maintain tilth and increase the intake of water. In places surface drains help to remove excess water more rapidly.

CAPABILITY UNIT IIs-3

Dempster silt loam, 0 to 2 percent slopes, is the only soil in this unit. This is a well-drained, nearly level soil that is moderately deep over sand and gravel. It has a surface layer and a subsoil of silt loam.

The soil in this unit is easy to work and has medium fertility. Available water capacity is only moderate, and the soil is somewhat droughty. Rooting depth and crop growth are limited by the underlying sand and gravel. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is slow. Conserving moisture is the main concern of management. Maintaining fertility and controlling soil blowing also are important.

Most areas are cultivated and are used for corn, oats, soybeans, and alfalfa. Such early maturing crops as small grain are better suited than such deep-rooted crops as corn and alfalfa. The soil also is suited to tame and native grass pasture and to other less intensive uses.

Managing crop residue and wind stripcropping help

to conserve moisture and control soil blowing. Leaving areas rough after fall plowing helps to catch moisture and control soil blowing. Applying chemical fertilizer helps to maintain fertility.

CAPABILITY UNIT IIIe-2

Egan-Shindler complex, 6 to 9 percent slopes, are the only soils in this unit. These are deep, well-drained, sloping soils on uplands. They have a surface layer and a subsoil of silty clay loam and clay loam.

The soils in this unit are easy to work and have medium or high fertility. Permeability is moderate in the subsoil. Available water capacity is high. Runoff is medium, and the hazard of erosion is severe especially if row crops are grown. Controlling water erosion is the main concern of management. Maintaining fertility and conserving moisture also are important.

Most areas are cultivated and are used for corn, oats, soybeans, alfalfa, and tame grasses.

Farming on the contour, terracing, and constructing grassed waterways help to control water erosion and conserve moisture. If slopes are too irregular for mechanical practices, the alternative is less use of row crops and greater use of small grain, tame grass, and legumes in the cropping system. These practices and the use of chemical fertilizer help to maintain fertility.

A few areas are in native grass and are used for grazing. Big bluestem, little bluestem, indiangrass, switchgrass, needle-and-thread, and blue grama are the main species. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 3,700 pounds per acre.

CAPABILITY UNIT IIIe-7

Thurman fine sandy loam, 2 to 6 percent slopes, is the only soil in this unit. This is a deep, somewhat excessively drained, gently undulating soil on uplands and terrace fronts. It has a surface layer of fine sandy loam and underlying material of loamy fine sand and fine sand.

The soil in this unit takes in water readily, but available water capacity is low or moderate, and the soil is droughty. Fertility is medium, and the organic-matter content is moderately low. Runoff is slow. The soil is subject to soil blowing. Controlling soil blowing and conserving moisture are the main concerns of management.

This soil is better suited to small grain than to corn or soybeans. It also is suited to pasture and hay plants and to other less intensive uses.

Managing crop residue, wind stripcropping, using minimum tillage, including close-sown crops in the cropping system, and using field windbreaks help to control soil blowing and conserve moisture. Spring plowing in place of fall plowing also helps to reduce the risk of soil blowing.

CAPABILITY UNIT IIIw-1

Worthing silty clay, the only soil in this unit, is a deep, poorly drained, level soil in closed depressions in the uplands. The entire profile is silty clay.

This soil has high fertility, but it is difficult to work because of wetness and poor tilth. Runoff ponds on this soil, and it remains wet for long periods. Reducing wetness and maintaining tilth are the main concerns of management.

If this soil is drained, it is suited to corn, soybeans, and small grain. Survival of alfalfa is limited by wetness. Red clover, alsike clover, and Ladino clover are satisfactory substitutes for alfalfa. During wet years, late-planted crops are better suited than small grain, but maturity of the crops before a killing frost is critical.

If outlets are available, wetness can be reduced by installing a surface or underground drainage system. Timely tillage helps to maintain tilth.

CAPABILITY UNIT IIIw-2

Luton silty clay, the only soil in this unit, is a deep, poorly drained, level soil on bottom lands. It has a surface layer and a subsoil of silty clay.

This soil has high fertility, but it is very difficult to work and good tilth is difficult to maintain. The soil dries slowly and compacts if it is worked when wet. Permeability is very slow. The soil is subject to flooding and has a high water table. Wetness commonly delays planting and tillage. Reducing wetness and maintaining tilth are the main concerns of management.

If the soil in this unit is adequately drained and protected from flooding, it is well suited to corn, soybeans, sorghum, small grain, and alfalfa. Survival of alfalfa is limited by wetness. Early maturing varieties of corn, soybeans, and sorghum are better suited than small grain in years of wetness during spring.

Dikes or floodwater diversions help to reduce damage from flooding. Deep, open drains help to remove excess water and to lower the water table. Managing crop residue, using timely tillage, and including grasses and legumes in the cropping system help to maintain tilth and increase the intake of water.

CAPABILITY UNIT IIIw-4

Bon soils, frequently flooded, are the only soils in this unit. These are deep, moderately well drained, nearly level soils on bottom lands. They have a surface layer of loam, silt loam, or fine sandy loam and underlying material of loam and fine sandy loam.

These soils have high fertility. Permeability is moderate. Available water capacity is high, but spring planting is delayed in most years by flooding. Runoff is slow. Soil blowing is a hazard in some years. Reducing wetness is the main concern of management. Controlling soil blowing is a concern in some areas.

The soils in this unit are better suited to corn, soybeans, sorghum, and pasture and hay than to other uses. Planting dates commonly are too late for small grain. Survival of alfalfa depends on the degree of damage from flooding.

Where feasible, dikes or floodwater diversions help to protect the areas from flooding. Managing crop residue and using minimum tillage help to control soil blowing.

Some areas are in native grasses and deciduous trees. Important grass species are big bluestem, indiangrass, prairie cordgrass, and Kentucky bluegrass. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 4,800 pounds per acre.

CAPABILITY UNIT IIIs-2

Dempster silt loam, 2 to 6 percent slopes, is the only soil in this unit. This is a well-drained, gently sloping soil that is moderately deep over sand and gravel. It has a surface layer and a subsoil of silt loam.

This soil is easy to work and has medium fertility. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Available water capacity is moderate, and the soil is somewhat droughty. The underlying sand and gravel limit the rooting depth and crop growth. Runoff is medium, and there is some risk of water erosion and soil blowing. Conserving moisture and controlling water erosion and soil blowing are the main concerns of management. Maintaining fertility also is a management concern.

This soil is used for corn, small grain, soybeans, and alfalfa. Small grain grows better than corn and other row crops that require more moisture. The soil also is suited to pasture and to other less intensive uses.

Managing crop residue and farming on the contour help to control water erosion and to conserve moisture. If slopes are too irregular for contouring, the alternative is to avoid the use of row crops in the cropping system. Leaving areas rough after fall plowing helps to control soil blowing and also helps to conserve moisture by catching snow. Applying fertilizer helps to maintain fertility.

CAPABILITY UNIT IIIs-3

Delmont loam, 0 to 2 percent slopes, is the only soil in this unit. This is a somewhat excessively drained, nearly level soil that is shallow over sand and gravel. It has a surface layer and a subsoil of loam.

This soil has medium fertility. Permeability is moderate in the subsoil and rapid in the underlying material. Available water capacity is low, and the soil is droughty. Runoff is slow. Conserving moisture is the main concern of management. Other management needs are controlling soil blowing and maintaining fertility.

Most areas are cultivated. The soil is better suited to small grain and other crops that make most of their growth early in summer. Sorghum is a drought-resistant crop, but it does not grow so well on this soil as on less droughty soils. The soil also is suited to pasture and to other less intensive uses.

Careful management of crop residue and wind stripcropping help to conserve moisture and control soil blowing.

CAPABILITY UNIT IVe-1

Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded, are the only soils in this unit. These are deep, well-drained, sloping soils on uplands that are moderately eroded to severely eroded. They have a surface layer of silty clay loam and a subsoil of silty clay loam or silt loam.

Because of erosion, these soils have medium or low fertility and moderate to moderately low organic-matter content. Available water capacity is high. In cultivated areas much of the surface layer has been removed by erosion, and the rest has been mixed with the subsoil by plowing. Controlling water erosion and soil blowing and improving fertility and organic-matter content are the main concerns of management.

Most areas are cultivated. The soils are suited to most crops grown in the county. However, they are not suited to row crops unless adequately protected from further erosion.

Managing crop residue, keeping tillage to a minimum, farming on the contour, contour stripcropping, terracing, and constructing grassed waterways (fig. 14) help to control water erosion and conserve moisture. Including grasses and legumes in the cropping system, using green-manure crops, and applying fertilizer help to improve fertility and the organic-matter content.

CAPABILITY UNIT IVe-3

Thurman fine sandy loam, 6 to 9 percent slopes, is the only soil in this unit. This is a deep, somewhat excessively drained, undulating soil on uplands and terrace fronts. It has a surface layer of fine sandy loam and underlying material of loamy fine sand and fine sand.

This soil takes in water readily. Fertility is medium, and the organic-matter content is moderately low. Available water capacity is low or moderate and the soil is droughty. Runoff is slow, but cultivated areas are subject to soil blowing and water erosion.

Some areas are cultivated. The soil in this unit is better suited to such crops as small grain that provide a cover throughout the year than to others. It also is suited to pasture and hay. Row crops are unsuited because the hazards of soil blowing and water erosion are too severe.

Managing crop residue, keeping tillage to a minimum, including close-sown crops in the cropping system, and planting field windbreaks help to control soil blowing and water erosion and to conserve moisture. Spring plowing instead of fall plowing also helps to reduce the risk of soil blowing. Including grasses and legumes in the cropping system and growing green-manure crops help to maintain fertility and the organic-matter content.

Some areas are in native grass and are used for pasture. Important grass species are sand bluestem, little bluestem, big bluestem, prairie sandreed, switchgrass, and needle-and-thread. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 3,600 pounds per acre.

CAPABILITY UNIT IVw-2

This unit consists of deep, poorly drained and somewhat poorly drained, level and nearly level soils on bottom lands and in depressions that are not drained or in which drainage measures are not feasible. These soils have a surface layer of silty clay loam and a subsoil of silty clay loam or silty clay.

The soils in this unit have high fertility, but they are difficult to work. Runoff is slow to ponded, and the soils remain wet for extended periods because of flooding and a seasonal high water table. Wetness delays farming operations and retards the growth of crops. Reducing wetness and maintaining tilth are the main concerns of management.

Many areas are cultivated. Alfalfa grows poorly because of wetness. Also, the soils are commonly too wet in spring for seeding small grain. Such late-planted crops as corn, soybeans, and sorghum grow well in

Figure 14.—**Grassed waterway and contour farming help to control erosion in this area of Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded.**

drier years if early maturing varieties are selected. The soils also are suited to tame and native grass pasture and to other less intensive uses, such as wildlife habitat.

Measures that reduce runoff from adjacent soils help to reduce wetness in some areas. Managing crop residue, growing green-manure crops, and using timely tillage help to maintain fertility and tilth.

Some areas remain in native vegetation and are used for pasture or hay. The important grass species are big bluestem, prairie cordgrass, switchgrass, indiangrass, and sedges. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 6,000 pounds per acre.

CAPABILITY UNIT IVs-2

This unit mainly consists of somewhat excessively drained, gently undulating to undulating soils that are shallow over sand and gravel. These soils have a surface layer and a subsoil of loam. Some of the soils that occur in a complex, however, are moderately well drained, and they are silty clay loam that is deep over sand and gravel.

The dominant soils in this unit are easy to work. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Available water capacity is low, and the soils are droughty. Runoff is medium, and the soils are subject to water erosion and soil blowing. Conserving moisture, controlling erosion and soil blowing, and maintaining fertility and the organic-matter content are the main concerns of management.

The soils in this unit are suited to small grain and to pasture and hay. Corn and other row crops seldom grow well because of droughtiness.

Managing crop residue, farming on the contour if slopes are not too irregular, keeping tillage to a minimum, and maintaining a cover of close-sown crops or stubble throughout the year help to meet the management needs of these soils.

Some areas are in native grass and are used for grazing. Important grass species are needle-and-thread, little bluestem, blue grama, and hairy grama. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 2,700 pounds per acre.

CAPABILITY UNIT Vw-1

Salmo silty clay loam, very wet, is the only soil in this unit. This is a deep, very poorly drained, level soil on bottom lands. It is calcareous silty clay loam throughout.

This soil is too wet and too frequently flooded to be suitable for cultivation. The water table is within a depth of 2 feet during much of the growing season. In addition, accumulations of salts are at or near the surface.

Most areas are in native vegetation and are used for pasture or hay (fig. 15).

The native vegetation is mainly prairie cordgrass, reed canarygrass, western wheatgrass, inland saltgrass, and slough sedge. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 6,000 pounds per acre.

CAPABILITY UNIT Vw-2

This unit consists of deep, poorly drained, level soils

Figure 15.—Area of Salmo silty clay loam, very wet. This soil is better suited to pasture than to most other uses.

on bottom lands and in closed depressions. These soils have a surface layer and a subsoil of silty clay.

The soils in this unit are too wet for cultivation. They are subject to flooding and have a high water table during much of the growing season. Improvement of drainage is feasible in some areas, but in many areas drainage is not feasible because suitable outlets are not available.

Nearly all of the areas are in native vegetation. The soils are used for hay in areas where the water table is low enough late in summer to permit haying. Some areas are managed for wildlife habitat.

The native vegetation is mainly prairie cordgrass, reed canarygrass, and slough sedge. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 6,500 pounds per acre.

CAPABILITY UNIT VIe-3

This unit consists of deep, well-drained, sloping to steep soils on uplands. These soils have a surface layer and a subsoil of silt loam, silty clay loam, and clay loam. In cultivated areas they commonly are moderately eroded to severely eroded.

The soils in this unit have high available water capacity, but they are too steep and too erodible for cultivation. Runoff is medium or rapid. Fertility is low or medium. Controlling erosion and conserving moisture are the main concerns of management.

These soils are better suited to pasture and hay than to other uses. In cultivated areas water erosion can be controlled by establishing a grass cover. In pastures proper use and contour furrows help to control water erosion and conserve moisture.

Many areas are in native grass and are used for pasture. The dominant species are big bluestem, little bluestem, indiangrass, switchgrass, green needlegrass, western wheatgrass, side-oats grama, and blue grama. If pasture is in excellent condition, the total annual yield of air-dry herbage is about 3,700 pounds per acre.

CAPABILITY UNIT VIw-1

Alcester silty clay loam, channeled, is the only soil in this unit. This is a deep, moderately well drained, nearly level soil on bottom lands along drainageways. It has a surface layer and a subsoil of silty clay loam.

This soil has high fertility and high available water capacity. Narrow areas are cut by meandering channels and are subject to flooding. Reducing wetness from flooding and controlling streambank erosion are the main concerns of management.

This soil is better suited to pasture than to hay or crops. Stabilization of streambanks helps to keep the channel from cutting into adjacent cropland. Straightening and deepening channels in some areas reduce flooding, but generally this is too costly.

Many areas are in native grass. The main species are big bluestem, switchgrass, indiangrass, green needlegrass, and western wheatgrass. If pasture is in excellent condition, the total annual yield of air-dry herbage is about 4,600 pounds per acre.

CAPABILITY UNIT VIs-3

The Talmo part of Delmont and Talmo soils, 2 to 9 percent slopes, is the only soil in this unit. This is an excessively drained, gently undulating to undulating soil that is very shallow over sand and gravel. It has a surface layer of gravelly loam.

This soil has low or very low available water capacity and is too droughty for cultivation. Fertility is low. Permeability is rapid. Conserving moisture and controlling soil blowing are the main concerns of management.

Most areas are in native grass and are used for pasture. Maintaining a good cover of grass helps to conserve moisture and control soil blowing.

The main native grasses are little bluestem, side-oats grama, prairie dropseed, needle-and-thread, blue grama, and sedges. If pasture is in excellent condition, the total annual yield of air-dry herbage is about 2,300 pounds per acre.

CAPABILITY UNIT VIIe-1

This unit consists of deep, well-drained, hilly to steep soils on uplands. These soils have a surface layer of loam or clay loam and a subsoil and underlying material of clay loam.

These soils have high available water capacity, but they are too steep and too erodible for cultivation. Most areas are too steep for the safe operation of farm machinery. Controlling water erosion is the main concern of management.

Most areas are in native grass or native trees and are used for grazing, recreation, and wildlife habitat. Most of the wooded areas are in Newton Hills State Park.

Maintaining a good cover of vegetation by proper grazing helps to control water erosion. Shaping and reseeding gullies and using grade stabilization structures help to control gully erosion.

Among the important native grasses on these soils are big bluestem, little bluestem, green needlegrass, needle-and-thread, side-oats grama, western wheatgrass, blue grama, and sedges. If native pasture is in excellent condition, the total annual yield of air-dry herbage ranges from 2,600 to 3,500 pounds per acre.

CAPABILITY UNIT VIIs-2

The Talmo part of Shindler and Talmo soils, 6 to 30 percent slopes, is the only soil in this unit. This is an excessively drained, sloping to steep soil that is very shallow over sand and gravel. It has a surface layer of gravelly loam.

This soil has low or very low available water capacity and is too droughty and too steep for cultivation. Fertility is low. Permeability is rapid. Conserving moisture and controlling soil blowing and water erosion are the main concerns of management.

This soil is suitable only for native pasture. Maintaining a good cover of grass helps to conserve moisture and control soil blowing and water erosion.

The important native grasses are little bluestem, side-oats grama, prairie dropseed, needle-and-thread, and sedges. If native pasture is in excellent condition, the total annual yield of air-dry herbage is about 2,100 pounds per acre.

CAPABILITY UNIT VIIIw-1

This unit consists of areas mapped as Marsh. The water level in these shallow basins or ponds fluctuates from one season to another.

These areas are too wet for cultivated crops or for pasture and hay. They are better suited to wildlife habitat than to most other uses. The vegetation consists of rushes, cattails, and other water-tolerant plants (fig. 16). The areas can be improved for wildlife habitat by constructing level ditches or shallow pits to provide open water.

Pasture [8]

Most of Lincoln County was once covered by grass. Scattered small areas are still in native grasses and are used for pasture. However, most of the pastures used for grazing consist of tame grasses seeded either as permanent pasture (fig. 17) or as rotation hay and pasture in a conservation cropping system.

[8] By PAUL M. BODEN, conservation agronomist, Soil Conservation Service.

Figure 16.—Aquatic vegetation in an area of Marsh, which is better suited to wildlife habitat than to most other uses.

Figure 17.—**Permanent pasture of tame grasses on Shindler-Egan complex, 9 to 15 percent slopes, eroded.**

The main objectives in the management of tame pasture are to maintain a vigorous stand of palatable forage for livestock feed, to improve the soil, and to control water erosion. Management that provides proper grazing, adequate soil fertility, clipping, and control of weeds helps to meet these objectives.

Proper grazing includes withholding livestock until the plants have a good start in spring, never grazing too closely, rotation grazing, grazing at the best time, and periodic resting. The addition of fertilizer as needed helps to maintain an adequate supply of plant nutrients. Clipping helps to distribute grazing and stimulate even regrowth. Where the stand is thin, control of weeds by mowing or spraying results in more moisture and more plant nutrients for desirable pasture plants.

Soils that are steep, very shallow over sand and gravel, or very wet are not suited to tame pasture. Better land use on such soils is native pasture, which requires grazing management that maintains the original native plant cover.

The soils of Lincoln County are grouped into nine pasture groups. Only those soils suitable for tame pasture are placed in a pasture group. In the following paragraphs are descriptions of the pasture groups, which name important soil characteristics and suitable pasture plants for each group. The letters used to identify the pasture groups are not in consecutive order because not all of the groups in the statewide system are used in Lincoln County. To find the pasture group of a given soil, refer to the "Guide to Mapping Units" at the back of this survey.

PASTURE GROUP A

This group consists of deep, somewhat poorly drained and poorly drained silty and clayey soils on bottom lands and in low areas in the uplands. These soils receive additional moisture from stream flooding or as runoff from adjacent soils. These soils have a seasonal high water table, but they are either artificially drained or the water table is at a shallow depth for such a short time that plant growth is not adversely affected.

All climatically adapted grasses and legumes are suited to these soils, but only plants capable of using the extra moisture are recommended. Among such plants are alfalfa, big bluestem, creeping foxtail, indiangrass, intermediate wheatgrass, reed canarygrass, smooth bromegrass, and switchgrass.

PASTURE GROUP B

This group consists of deep, somewhat poorly drained and poorly drained silty and clayey soils on bottom lands and in low areas in the uplands. These soils have a water table within the rooting zone and also receive additional moisture from stream flooding or as runoff from adjacent soils. Soils in this group are not artificially drained, and in many areas improvement of drainage is not feasible.

The excess moisture in these soils limits the choice of pasture plants to water-tolerant species. Among such plants are creeping foxtail, reed canarygrass, and western wheatgrass.

PASTURE GROUP D

This group consists of somewhat excessively drained and well-drained loamy and silty soils that are shallow to moderately deep over sand and gravel. These soils have low or moderate available water capacity and are droughty or somewhat droughty. Choice of plants and production of forage plants are limited by the less than optimum available water capacity.

The soils that are moderately deep over sand and gravel are suited to such grasses and legumes as alfalfa, intermediate wheatgrass, and smooth bromegrass. The soils that are shallow to sand and gravel are suited to crested wheatgrass and pubescent wheatgrass.

PASTURE GROUP F

This group consists mainly of deep, well-drained, nearly level to hilly silty soils on uplands. It also includes a deep, moderately well drained, calcareous silty soil that has a seasonal high water table in most years. Most of these soils have medium or high fertility and moderate permeability in the subsoil.

All climatically adapted plants are suitable, but bunch-type species are not suited if slopes are more than 6 percent. Among the suitable grasses and legumes are alfalfa, big bluestem, green needlegrass, indiangrass, intermediate wheatgrass, smooth bromegrass, and switchgrass.

PASTURE GROUP G

This group consists of deep, well-drained, gently sloping to hilly silty and loamy soils that are calcareous at a depth of 0 to 10 inches. These soils are on uplands and have high available water capacity but are low or medium in fertility. Choice of plants and production of forage plants are limited by the high content of lime and by the severe hazard of erosion.

The soils in this group are suited to such grasses and legumes as alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass.

PASTURE GROUP H

This group consists of deep, somewhat excessively drained, gently undulating to undulating soils that have a surface layer of fine sandy loam and underlying material of loamy fine sand and fine sand. These soils have rapid permeability and low or moderate available water capacity. They are highly susceptible to soil blowing.

The choice of plants is limited by droughtiness and the severe hazard of soil blowing. The soils in this group are suited to such grasses and legumes as alfalfa, big bluestem, indiangrass, intermediate wheatgrass, smooth bromegrass, and switchgrass.

PASTURE GROUP I

Huntimer silty clay loam, 0 to 2 percent slopes, is the only soil in this group. This is a deep, well-drained, nearly level soil on uplands. Permeability is slow. The clayey subsoil takes in water slowly and releases moisture slowly to plants. Available water capacity is moderate or high.

The soil in this group is suited to such grasses and legumes as alfalfa, green needlegrass, intermediate wheatgrass, and smooth bromegrass.

PASTURE GROUP J

Salmo silty clay loam, very wet, is the only soil in this group. This is a very poorly drained silty soil on bottom lands. It is flooded frequently, and the water table is at or near the surface. It also has accumulations of salts at or near the surface.

The choice of plants is severely limited by wetness and salinity. Among the suitable pasture species are tall wheatgrass and western wheatgrass.

PASTURE GROUP K

This group consists of deep, moderately well drained loamy and silty soils on bottom lands and on flats and in swales in the uplands. These soils receive additional moisture from flooding or as runoff from adjacent soils. Permeability is moderate in the subsoil, and available water capacity is high.

All climatically adapted plants are suited to these soils, and production of forage plants is higher than on nearby, well-drained soils because of the favorable moisture. The soils in this group are suited to such grasses and legumes as alfalfa, big bluestem, creeping foxtail, indiangrass, intermediate wheatgrass, reed canarygrass, smooth bromegrass, and switchgrass.

Yield Predictions

Table 2 lists the predicted average annual yields per acre for the principal dryfarmed crops under two levels of management. Only the soils that are judged to be suitable for crops or tame pasture are listed. Predictions of yields of irrigated crops are not available. The irrigated acreage in the county is small and is mostly in corn. Yields can be increased on most soils in the county if enough water is applied and a high level of management is practiced.

Yields in columns A can be expected under management that is customarily practiced in this county. For example, the cropping system is made up mainly of cultivated crops. The common crop sequence is 2 years of row crops (corn and soybeans) and 1 year of oats. The optimum number of corn plants per acre for maximum yields is not planted. A green-manure crop is seeded with the oats about every 6 years. Alfalfa is grown in rotation 2 years in 15. Pasture areas are seldom rotated. Crop residue is usually plowed under. Where corn is taken for silage, no substitute residue is applied. Barnyard manure is applied only to the fields nearest the buildings. Some fertilizer is used on corn and on oats, but optimum fertilization for maximum yields of all crops and pasture is not accomplished. Crop and pasture yields are reduced by weeds, insects, and disease in most years. More erosion control practices are needed. Better drainage systems are needed for wet soils.

Yields in columns B are those expected under improved management. The requirements of good management vary according to the soils, but under this level of management, crops and pasture plants best suited to the soils are grown in a suitable cropping system. Legumes and grasses are grown in a rotation that includes all of the fields on the farm. Crop residue is carefully managed to maintain fertility and tilth. Where corn is cut for silage, green-manure crops are seeded the next season to supplement the supply of organic matter. Clean, high-quality seed of disease-resistant varieties is used. Plant populations are used that produce the maximum yields. Fertilizer is applied in the kinds and quantities indicated by the results of soil tests and field experience. Weeds, insects, and diseases are adequately controlled by the effective use

TABLE 2.—*Predicted average annual yields per acre of principal dryfarmed crops and tame pasture*

[Yields in columns A are those to be expected under management that is commonly practiced; yields in columns B are those to be expected under improved management. The absence of a yield figure indicates that the crop is not commonly grown on the soil or that the soil is not suited to the crop. Yields for soil complexes are weighted averages based on the proportionate extent and relative productivity of the soils in the complex. Only soils suited to crops or tame pasture are listed]

Soil	Corn		Oats		Soybeans		Alfalfa		Tame pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*AUM* [1]	*AUM* [1]
Alcester silty clay loam, 0 to 2 percent slopes	74	91	59	82	24	37	2.9	4.2	4.8	7.0
Alcester silty clay loam, 2 to 6 percent slopes	70	88	53	80	20	33	2.8	3.9	4.7	6.5
Alcester silty clay loam, channeled	---	---	---	---	---	---	---	---	4.8	7.0
Alcester and Lamo silty clay loams:										
Alcester part	74	91	59	82	24	37	2.9	4.2	4.8	7.0
Lamo part	65	85	52	73	21	30	2.9	4.1	4.8	6.9
Bon soils, frequently flooded	45	65	42	61	19	29	2.8	4.1	4.7	6.9
Chancellor-Tetonka silty clay loams	50	70	49	69	17	28	2.2	3.3	3.7	5.6
Chancellor-Viborg silty clay loams	58	81	55	79	21	32	2.8	3.8	4.1	6.1
Chancellor-Wakonda-Tetonka complex	49	69	49	69	16	25	2.0	3.1	3.4	5.1
Clamo silty clay loam	53	70	39	56	20	29	2.8	3.7	4.7	6.2
Crofton-Nora silt loams, 9 to 17 percent slopes, eroded	---	---	---	---	---	---	---	---	2.7	4.0
Davis loam	75	91	56	84	22	32	3.1	4.3	5.2	7.2
Delmont loam, 0 to 2 percent slopes	24	35	27	43	9	16	1.0	1.7	1.7	2.8
Delmont loam, 2 to 6 percent slopes	21	32	26	39	8	13	.9	1.6	1.5	2.7
Delmont-Graceville complex, 2 to 6 percent slopes	38	56	37	53	13	20	1.5	2.5	2.6	4.2
Delmont and Talmo soils, 2 to 9 percent slopes:										
Delmont part	18	25	23	35	7	11	.8	1.5	1.4	2.6
Talmo part	---	---	---	---	---	---	---	---	---	---
Dempster silt loam, 0 to 2 percent slopes	53	75	53	78	19	30	2.2	3.1	3.0	4.2
Dempster silt loam, 2 to 6 percent slopes	48	67	50	74	18	29	2.0	3.0	2.7	4.0
Egan silty clay loam, 3 to 6 percent slopes	61	80	53	80	20	29	2.5	3.5	4.2	5.8
Egan-Chancellor silty clay loams, 2 to 4 percent slopes	58	78	52	77	19	27	2.4	3.4	4.0	5.7
Egan-Shindler complex, 2 to 6 percent slopes	52	71	50	71	18	25	2.2	3.2	3.7	5.3
Egan-Shindler complex, 6 to 9 percent slopes	42	60	41	60	15	22	2.0	3.0	3.3	5.0
Egan-Worthing complex, 2 to 6 percent slopes	55	73	50	75	18	27	2.3	3.3	3.9	5.5
Graceville silty clay loam	70	88	55	77	20	31	2.5	3.8	4.2	6.3
Huntimer silty clay loam, 0 to 2 percent slopes	54	73	52	76	16	24	2.1	3.0	3.5	5.0
Lamo silty clay loam	65	85	52	73	21	30	2.9	4.1	4.8	6.9
Luton silty clay	47	64	36	63	18	29	2.0	3.3	3.3	5.5
Moody silty clay loam, 0 to 2 percent slopes	72	90	53	80	25	37	2.8	4.0	4.7	6.7
Moody silty clay loam, 2 to 6 percent slopes	68	88	52	77	24	33	2.7	3.9	4.5	6.5
Moody-Nora silty clay loams, 2 to 6 percent slopes	60	80	51	72	22	31	2.6	3.7	4.3	6.2
Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded	48	70	40	60	16	22	2.2	3.0	3.5	4.8
Salmo silty clay loam, very wet	---	---	---	---	---	---	---	---	2.7	4.3
Shindler clay loam, 9 to 15 percent slopes	---	---	---	---	---	---	---	---	2.5	4.5
Shindler-Egan complex, 9 to 15 percent slopes, eroded	---	---	---	---	---	---	---	---	2.5	4.5
Shindler and Talmo soils, 6 to 30 percent slopes:										
Shindler part	---	---	---	---	---	---	---	---	2.5	4.5
Talmo part	---	---	---	---	---	---	---	---	---	---
Tetonka silty clay loam	45	61	44	62	16	25	2.2	3.2	3.7	5.5
Thurman fine sandy loam, 2 to 6 percent slopes	32	48	30	45	11	16	1.3	1.8	2.2	3.6

TABLE 2.—*Predicted average annual yields per acre of principal dryfarmed crops and tame pasture*—Continued

Soil	Corn		Oats		Soybeans		Alfalfa		Tame pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*AUM* [1]	*AUM* [1]
Thurman fine sandy loam, 6 to 9 percent slopes	27	40	25	40			1.2	1.8	2.0	3.3
Wentworth silty clay loam, 0 to 2 percent slopes	70	88	55	83	22	33	2.7	3.8	4.5	6.3
Wentworth-Chancellor silty clay loams, 0 to 2 percent slopes	60	84	54	80	21	32	2.6	3.5	4.3	6.1
Worthing silty clay	44	62	49	67	15	24	2.1	3.0	3.4	5.0

[1] AUM = Animal unit months, the number of animal units (1,000 pounds live weight) that can be grazed on 1 acre of pasture for one month without damage to the sod.

of chemicals and mechanical practices. Wet soils are drained, and tillage operations are carefully timed to prevent destruction of soil structure and tilth. Erosion is controlled.

The yield predictions in table 2 are based on observations and comparisons made by farmers and by agriculturists of State and Federal agencies. These predictions are long-term averages. They take into account the years when the moisture supply is plentiful and years when it is not. They also take into account the probable loss caused by damaging hailstorms and late or early frost.

Woodland and Windbreaks [4]

Lincoln County has approximately 4,440 acres of native woodland, most of which is on bottom lands, breaks, and draws adjacent to streams. The largest natural wooded area is in the southeastern part of the county (fig. 18).

The principal tree and shrub species are American basswood, American elm, American hornbeam, American plum, bur oak, common chokecherry, smooth sumac, and several species of *Ribes* and *Symphori-*

[4] By DAVID L. HINTZ, forester, Soil Conservation Service.

Figure 18.—Native woodland in Newton Hills State Park on Shindler-Renner complex, 15 to 40 percent slopes.

Figure 19.—**Excellent 8-year-old farmstead windbreak on Wentworth silty clay loam, 0 to 2 percent slopes.**

carpos. A small amount of black locust, black walnut, and hackberry is in the same areas. Boxelder, eastern cottonwood, and several species of willow are common in the wetter areas along streams.

The native woodlands are valued mainly for wildlife habitat, recreation, esthetic value, erosion control, and watershed protection. However, some trees are cut for timber, fuelwood, posts, and poles. Much of the native woodland has not been fenced to exclude livestock and is used for woodland pasture. In general this grazing has been detrimental to the growth of young trees.

Windbreaks have been planted since the days of early settlers. In most cases the early plantings were for the protection of the farmstead and livestock. Many farmsteads still need this kind of windbreak. There also is a growing interest in the planting of field windbreaks to help control soil blowing on soils that are susceptible to it. Thousands of acres in Lincoln County still need windbreaks.

Windbreaks benefit the landowner economically and environmentally (*2*). They distribute and hold snow, which prevents it from becoming a problem around the farmstead; protect the home and livestock from cold wintery winds and thereby reduce fuel and feed costs; protect field crops, gardens, and orchards from strong damaging wind; reduce evaporation of moisture; provide a suitable habitat for many kinds of birds and other wildlife; help to control soil blowing; and enhance the beauty of the rural home and its surroundings (fig. 19).

Purpose of planting, suitability of the soils for windbreaks, and location should be considered before a windbreak is planted. Establishment of a windbreak and continued growth of the trees depend on careful selection and suitable preparation of the site and on adequate maintenance. Grass and weeds need to be eliminated before the trees are planted. Regrowth of the ground cover needs to be controlled for the entire life of the windbreak. Some replanting usually is necessary 1 or 2 years after the initial planting.

The soils in Lincoln County are grouped according to their suitability for windbreak plantings. In the following paragraphs these windbreak groups are described. The numbers used to designate the groups are not consecutive because not all of the groups in the statewide system are present in Lincoln County. Also, not all of the soils of a given soil series are necessarily in the same group. To find the windbreak group of a given soil, refer to the "Guide to Mapping Units" at the back of this survey.

WINDBREAK GROUP 1

This group consists of deep, moderately well drained, nearly level to gently sloping, silty and loamy soils. These soils receive additional water as runoff from adjacent soils or are subject to occasional flooding. Some of the soils have a water table within reach of

tree roots, but the wetness limitation is minor. The moisture regime is highly favorable for tree growth.

Soils of this group are well suited to windbreaks for protection of farmsteads, feedlots, and fields. They also are well suited to recreation and wildlife plantings. Planting on the contour helps to control erosion on the gently sloping soils.

WINDBREAK GROUP 2

This group consists of deep, somewhat poorly drained and poorly drained, level and nearly level, silty and clayey soils. The water table is high enough to limit the growth and development of roots in these soils. The water table also limits the selection of trees and shrubs to those that tolerate wetness.

Soils of this group are well suited to windbreaks for protection of farmsteads, feedlots, and fields. They also are well suited to recreation and wildlife plantings.

WINDBREAK GROUP 3

This group consists of deep, well-drained, nearly level to sloping, silty and loamy soils on uplands. Permeability is moderate in the subsoil, and available water capacity is high. Fertility is medium or high. The hazard of water erosion is moderate to severe on the gently sloping to sloping soils, and the hazard of soil blowing is slight to moderate.

Soils of this group are well suited to windbreaks for protection of farmsteads, feedlots, and fields. They also are well suited to recreation, beautification, and wildlife plantings. Planting on the contour and terracing help to control erosion and to conserve moisture on the gently sloping to sloping soils.

WINDBREAK GROUP 4

Huntimer silty clay loam, 0 to 2 percent slopes, is the only soil in this group. This is a deep, well-drained, nearly level soil that has a subsoil of silty clay. Fertility is high. Available water capacity is moderate or high, but the clayey subsoil takes in water slowly and releases moisture slowly to plants.

The soil of this group is moderately well suited to windbreaks for protection of farmsteads, feedlots, and fields. It can also be used for wildlife, recreation, and beautification plantings.

WINDBREAK GROUP 5

This group consists of deep, somewhat excessively drained, gently undulating to undulating, loamy soils on uplands and terrace fronts. These soils have a surface layer of fine sandy loam and underlying material of loamy fine sand and fine sand. Fertility is medium. Permeability is rapid, and available water capacity is low or moderate. The hazard of soil blowing is severe.

Soils of this group are moderately well suited to windbreaks for protection of farmsteads, feedlots, and fields. They also are moderately well suited to recreation, wildlife, and beautification plantings. Growing cover crops and using crop residue as a mulch help to control soil blowing while the windbreak is being established. Scalp planting is recommended in areas where the surface layer is loamy fine sand.

WINDBREAK GROUP 6

This group consists of well-drained, nearly level to gently sloping silty soils that are moderately deep over sand and gravel. Fertility is medium. Available water capacity is moderate. These soils are too droughty for most trees and shrubs because of the underlying sand and gravel.

Soils of this group are poorly suited to windbreak plantings. They can be used for wildlife, recreation, and beautification plantings if optimum growth is not a critical factor. Contour plantings on the gently sloping soils help to conserve moisture.

WINDBREAK GROUP 10

This group consists of soils that are too steep, too stony, or too wet for tree planting with machinery. Some of these soils have low fertility. Some are too droughty or too wet for good survival and growth of trees and shrubs.

Soils of this group are not suited to windbreaks planted with machinery. They can be used for wildlife, recreation, and beautification plantings if the trees and shrubs are hand planted and are given special care. Tree and shrub species need to be selected that are tolerant of the limitations at each site.

Table 3 lists most of the trees and shrubs used in windbreak plantings and their probable performance on the soils of each windbreak group. Soils in windbreak group 10 are not suitable for windbreaks. The table shows the actual or estimated height and vigor of each species at 20 years of age. All height measurements and vigor ratings are based on well-managed plantings. The ratings in the vigor columns refer to density of foliage, freedom from damage by insects and disease, and general appearance of the tree or shrub. They are defined as follows:

Good.—One or more of the following is present: leaves or needles are normal in color and growth; only a small amount of deadwood (tops, branches, twigs) is within the live crown; evidence of damage by disease, insects, or climate is limited; there is little or no evidence of stagnation or suppression.

Fair.—One or more of the following is present: leaves or needles are abnormal in color or growth; a substantial amount of deadwood (tops, branches, twigs) is within the live crown; evidence of moderate damage by disease, insects, or climate is obvious; definite suppression or stagnation exists; current year's growth is obviously less than normal.

Poor.—One or more of the following is present: leaves or needles are very abnormal; a large amount of deadwood (tops, branches, twigs) is within the live crown; evidence of extensive damage by disease, insects, or climate is obvious; plants show the effects of severe stagnation, suppression, or decadence; current year's growth is negligible. Plants that have this rating are not recommended for farmstead, feedlot, or field windbreaks. They may be satisfactory for some wildlife and beautification plantings.

Wildlife [5]

In this section the soils of Lincoln County, as they are suited to wildlife habitat, are discussed in relation to the soil associations shown on the general soil map.

[5] By JOHN B. FARLEY, biologist, Soil Conservation Service.

TABLE 3.—*Vigor and height of trees and shrubs*

[Estimates of height not given for species rated poor. Soils

Species	Group 1		Group 2	
	Vigor	Height	Vigor	Height
		Ft		*Ft*
Trees:				
Black Hills spruce	Good	24–30	Good	20–24
Blue spruce	Good	24–30	Good	20–24
Boxelder	Fair	20–22	Fair	18–20
Chinkota elm	Good	32–36	Good	24–28
Dropmore elm	Good	32–36	Good	24–28
Eastern cottonwood	Fair to good	35–40	Poor	
Eastern redcedar	Good	15–18	Good	14–16
Golden willow	Good	32–35	Good	30–34
Green ash	Good	23–27	Good	20–24
Hackberry	Good	23–27	Good	22–26
Harbin pear	Good	16–18	Good	14–16
Honeylocust	Good	30–34	Good	30–34
Manchurian crabapple	Good	18–20	Good	16–18
Plains cottonwood	Fair to good	35–40	Poor	
Ponderosa pine	Good	24–30	Good	20–22
Rocky Mountain juniper	Good	15–18	Good	14–16
Siberian crabapple	Good	18–20	Good	16–18
Siberian elm	Good	32–36	Good	24–28
Siouxland cottonwood	Fair to good	35–40	Poor	
White willow	Good	32–35	Good	30–34
Shrubs:				
American plum	Good	8–9	Good	5–6
Chokecherry	Good	12–14	Fair	9–11
Lilac	Good	7–8	Good	5–6
Nanking cherry	Good	5–7	Fair	4–5
Peking cotoneaster	Good	6–7	Fair	5–6
Russian-olive	Fair	16–20	Fair	14–16
Siberian peashrub (caragana)	Good	9–11	Fair	7–9
Silver buffaloberry	Good	8–10	Fair	6–8
Tartarian honeysuckle	Good	8–10	Good	6–8

The wildlife discussed here consists mainly of game species.

Wentworth-Chancellor association.—This association is intensively farmed. The small pastures are mostly in tame grasses. The natural occurrence of woody plants is limited to stringers of trees along the larger creeks and drainageways, but many of the farmsteads have small windbreaks, mainly of tall trees. Natural wetlands are of little significance in the area, and most of the small closed depressions are drained or are seldom wet enough to provide habitat for waterfowl or furbearers. The lack of unused herbaceous cover is a distinctive feature of this soil association.

The soils in this area have a high potential for producing habitat favorable for farm game species, such as pheasant, cottontail, jackrabbit, and mourning dove. However, the intensity of farming in the area limits the realization of this potential. A small number of white-tailed deer is in the area, mainly along the larger creeks. Most farm ponds are of the dugout type, and while they provide drinking water for wildlife they usually do not have a potential as sport fisheries, nor do they provide habitat for rearing ducks.

Field border plantings and field windbreaks enhance the wildlife habitat in this area. Adding exterior shrub rows, underplanting with shade-tolerant species, and excluding livestock help to increase the wildlife habitat value of farmstead windbreaks. Proper use of pasture also benefits wildlife habitat.

Egan-Shindler-Worthing association.—This association has many scattered potholes or depressions. Most of the well-drained soils are intensively farmed, but some of the steeper soils are used for pasture. The wetland areas of Marsh and undrained areas of the Worthing soil in depressions are the main features of this association that affect its wildlife potential.

The wildlife habitat in this association is the most favorable in the county for pheasant, waterfowl, shorebirds, and furbearers. The wetland habitat also is favorable for deer, songbirds, and small mammals.

Wildlife habitat of the wetlands can be improved by constructing level ditches or shallow pits to provide open water. On the well-drained soils, using border plantings and field windbreaks, adding exterior rows of shrubs to farmstead windbreaks, seeding odd areas, and constructing grassed waterways are among the measures that help to improve wildlife habitat.

Egan-Chancellor association.—Most of this association is intensively farmed, but undrained depressions in some areas are used for pasture and wildlife habitat. Stringers of native trees are along creeks and drainageways, especially in the northeastern part of the county. Most of the farmsteads have small windbreaks.

This association has a high potential for farm game

at 20 years of age, by windbreak groups

in windbreak group 10 are not suited to windbreaks]

Group 3		Group 4		Group 5		Group 6	
Vigor	Height	Vigor	Height	Vigor	Height	Vigor	Height
	Ft		*Ft*		*Ft*		*Ft*
Good	24–28	Poor		Poor		Poor	
Good	24–28	Poor		Poor		Poor	
Fair	20–22	Poor		Poor		Poor	
Good	30–32	Good	36–40	Fair	20–24	Fair	16–20
Good	30–32	Good	36–40	Fair	20–24	Fair	16–20
Poor		Poor		Poor		Poor	
Good	13–15	Good	15–17	Good	13–15	Fair	9–11
Poor		Poor		Poor		Poor	
Good	20–24	Fair	21–26	Good	22–26	Fair	12–14
Good	20–24	Good	22–24	Good	21–25	Fair	10–12
Good	15–17	Fair	13–15	Good	15–17	Fair	11–12
Fair	26–30	Fair	24–26	Fair	28–32	Fair	15–17
Good	15–17	Fair	13–15	Good	17–19	Fair	12–14
Poor		Poor		Poor		Poor	
Good	22–26	Good	17–23	Good	20–24	Fair	13–15
Good	13–15	Good	15–17	Good	13–15	Fair	9–11
Good	15–17	Fair	13–15	Good	17–19	Fair	12–14
Good	30–32	Good	36–40	Fair	20–24	Fair	16–20
Poor		Poor		Poor		Poor	
Poor		Poor		Poor		Poor	
Good	8–9	Good	8–9	Good	6–7	Poor	
Good	9–12	Good	10–12	Fair	9–11	Poor	
Good	6–7	Fair	4–5	Good	6–7	Fair	4–5
Fair	5–6	Fair	4–5	Fair	4–5	Poor	
Good	5–6	Good	6–7	Good	6–7	Fair	4–5
Fair	15–18	Fair	16–22	Fair	14–18	Fair	9–12
Good	9–10	Fair	7–8	Good	8–10	Fair	6–7
Good	7–9	Good	7–9	Fair	6–8	Fair	5–6
Good	7–9	Good	8–10	Good	6–7	Fair	5–7

species, such as pheasant and cottontail, and for a limited number of white-tailed deer. The wetland areas also provide favorable habitat for waterfowl, especially during years of above-normal precipitation.

Adding exterior rows of shrubs, using understory plantings, and protecting the areas from livestock enhance the value of farmstead windbreaks for wildlife. Planting field windbreaks, using border plantings, and properly grazing the pastures also enhance the wildlife potential of this association.

Chancellor-Wakonda-Tetonka association.—Most of this association is used for crops, but many of the undrained areas of poorly drained soils are used for pasture. Small windbreaks are around many of the farmsteads.

This association has a moderate potential for farm game species. The poorly drained soils provide habitat for waterfowl, furbearers, and pheasants.

By plugging drainage outlets in drained areas, good wetland habitat can be restored on these poorly drained soils. Wildlife benefits also result from improving grazing management of pastures, planting field windbreaks, and improving existing farmstead windbreaks.

Shindler-Steinauer-Renner association.—This association consists of hilly to steep soils on breaks to the Big Sioux River and its tributaries. Most areas are in native vegetation, which consists of open grassland intermingled with mixed stands of native trees and shrubs. Privately owned land is used mainly for grazing, but much of the woodland is within Newton Hills State Park, which is used for public recreation.

This association provides essential habitat for many kinds of wildlife. Many species of wildlife migrate from the lowlands along the Big Sioux River to feed in this association and on the croplands of adjacent associations. The key habitat for 80 percent of the deer population in the county is in this association. Trial plantings of wild turkey have been made in this association with good results.

Within this association is Lake Alvin, an 80-acre reservoir on Ninemile Creek. It provides swimming, water sports recreation, and fishing. Fishery management is for largemouth bass, bluegill, northern pike, walleye, yellow perch, crappie, and bullhead. This lake also is used as a rest area for migrating geese and ducks.

Moody-Nora-Alcester and Nora-Moody-Crofton associations.—Most of these areas are intensively farmed, but some of the strongly sloping soils are used for pasture and hay. Many excellent farmstead windbreaks and a number of field windbreaks provide habitat for wildlife. Many of the natural drainageways have a good potential for native woody plants. In some areas

conservation treatment of cultivated soils has improved the habitat for farm game species.

These associations have a good potential for farm game species, such as pheasant, cottontail, and jackrabbit. It also has fair potential for deer. A few farm ponds provide bass-bluegill fisheries and also benefit waterfowl.

Lake Lakota, a 93-acre flood retardation reservoir on Pattee Creek, benefits wildlife and provides basic facilities for recreation. It also serves as a fishery for walleye, largemouth bass, and rainbow trout. Migrating geese and ducks use Lake Lakota as a migratory stop and provide hunters with field shooting opportunities on nearby cropland.

Lamo-Bon-Clamo association.—This association is used about equally for crops and for pasture and hay, but it contains significant areas of natural woodlands, especially along the Big Sioux River.

White-tailed deer are most abundant in the natural woodlands, but red fox, squirrel, opossum, beaver, mink, muskrat, skunk, cottontail, raccoon, coyote, and bobwhite also inhabit these areas. Pheasants commonly winter in this woody habitat. Birds nesting in these wooded areas include red-tailed hawk, rough-legged hawk, great horned owl, and wood duck.

The most intensively farmed parts of this association have good potential for farm game species, such as pheasant, cottontail, jackrabbit, and mourning dove.

Graceville-Dempster and Delmont-Graceville-Talmo associations.—Most areas of these soils are cultivated, but Talmo soils are used mostly for pasture. A few stringers of native trees are along Long Creek, but otherwise there is little woodland habitat in these areas. Some areas, however, are adjacent to soil associations that have an abundance of woody habitat.

These associations have good potential for farm game species, such as pheasant and cottontail. They also provide feeding grounds for wildlife from adjacent soil associations. These wildlife include white-tailed deer, wild turkey, bobwhite, red fox, raccoon, and opossum.

Abandoned gravel pits in these associations provide excellent habitat for pheasant and deer.

Engineering Uses of the Soils [6]

This section is useful to those who need information about soils used as structural material or as foundation material upon which structures are built. Among those who can benefit from this section are planning commissioners, town and city managers, sanitarians, land developers, realtors, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compaction characteristics, shrink-swell potential, soil drainage condition, grain size, plasticity, and soil reaction. Also important are depth to water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect the construction and maintenance of roads, highways, airports, pipelines, foundations for small buildings, irrigation and drainage systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section can be helpful to those who:

1. Select potential residential, industrial, commercial, and recreation areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of sand, gravel, topsoil, and road-fill material.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil elsewhere.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.
8. Determine potential sources of pollution.

Most of the information in this section is presented in tables 4, 5, 6, and 7, which show estimates of several soil properties significant in engineering, interpretations for several engineering uses, and results of engineering laboratory tests on soil samples. This information, along with the soil map and other parts of this publication, can be used to make additional interpretations not shown in table 5.

This information, however, does not eliminate the need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavation to depths greater than those shown in table 4. Also, inspection of sites commonly is needed because many areas of a given soil mapping unit may contain small areas of other kinds of soil that have contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary at the back of this publication defines many of these terms as they are used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*9*) used by the Soil Conservation Service, the Department of Defense, and other agencies and the AASHO system (*1*) adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped into 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

[6] LEONARD P. KUCK, agricultural engineer, Soil Conservation Service, helped prepare this section.

The AASHO system is used in classifying soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups that range from A–1 to A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and are the poorest mineral soils for subgrade. If laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b; A–2–4, A–2–5, A–2–6, A–2–7; and A–7–5, A–7–6. As additional refinement, the engineering value of soil material can be indicated by group index numbers, which range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in tables 6 and 7. The estimated classification, without index numbers, is shown in table 4 for all soils mapped in the county.

Estimated properties significant in engineering

Estimates of several soil properties significant in engineering are shown in table 4. These estimates are made for the representative profile of each series by layers significant for soil engineering. They are based on field observations made during mapping, on test data for selected soils, and on experience with the same kinds of soil in other counties. Following are explanations of the columns in table 4.

Depth to seasonal high water table is the distance from the surface of the soil downward to the highest level reached in most years by ground water.

Soil textures shown in table 4 are in standard terms used by the U.S. Department of Agriculture. These textures are determined by the relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

The estimated percentage of material passing sieve numbers 4, 10, 40, and 200 reflects the normal range in texture for a soil series. Most soils fall within the range given, but it should be assumed that some soils do not.

Liquid limit and plasticity index pertain to the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material changes from a semisolid to a plastic state, and the *liquid limit,* from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Permeability is that quality of a soil that enables it to transmit water or air. The estimates in table 4 are based on soil structure and texture and do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of the soil to hold water for use by most plants. It commonly is defined as the difference between the amount of water in the soil at field capacity and the amount in the soil at the wilting point of most plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of a saturation extract, in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for production of crops, its stability when used for construction material, and its corrosivity to metals and concrete.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material that has this rating.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than those entirely within one kind of soil or in one soil horizon. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulphate, but also by soil texture and acidity. A rating of *high* means there is a high probability of damage, so that protective measures for steel and more resistant material in concrete are needed to reduce damage.

Engineering interpretations of the soils

The interpretations in table 5 are based on the estimated engineering properties of soils shown in table 4, on test data for soils in this county or nearby counties, and on the experience of engineers and soil scientists with the soils of Lincoln County. In table 5, ratings are given to summarize limitation or suitability of the soils for uses other than pond reservoirs, embankments, drainage, irrigation, and terraces and diversions. For those particular uses, table 5 lists soil features that need to be considered in planning, installation, and maintenance.

Soil limitations are indicated by the ratings *slight, moderate,* and *severe. Slight* means soil properties are favorable for the rated use, and the limitations are minor or easily overcome. *Moderate* means some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special design. A severe limitation does not mean that the soil is excluded from a specific use.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 5.

Septic tank absorption fields are affected mainly by

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Dominant USDA texture	Classification		Percentage less than 3 inches passing sieve—			
				Unified	AASHO	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No.200 (0.074 mm)
	Ft	*In*							
*Alcester: AcA, AcB, Af Ah. For Lamo part of An, see Lamo series.	>5	0–32	Silty clay loam	ML or CL	A–4 or A–6	100	98–100	90–100	70–90
		32–60	Silty clay loam	ML or CL	A–6 or A–7	100	98–100	90–100	75–100
Bon: Ba	[1]2–8	0–24	Loam	ML or CL	A–4 or A–6	100	100	85–95	60–75
		24–45	Fine sandy loam	ML or SM	A–4	100	95–100	70–85	40–55
		45–60	Stratified fine sandy loam and loamy fine sand.	SM	A–2 or A–4	100	95–100	50–95	20–45
*Chancellor: Ca, Cd, Ch. For Tetonka part of Ca and Ch, see Tetonka series; for Viborg part of Cd, see Viborg series; for Wakonda part of Ch, see Wakonda series.	2–5	0–18	Silty clay loam	CL	A–7 or A–6	100	98–100	95–100	80–100
		18–36	Silty clay	CL or CH	A–7	100	98–100	95–100	80–100
		36–60	Silty clay loam	CL or CH	A–7	100	98–100	95–100	80–100
Clamo: Co	[1]2–8	0–16	Silty clay loam	CL or CH	A–7 or A–6	100	100	95–100	85–100
		16–60	Silty clay	CL or CH	A–7	100	95–100	95–100	85–100
*Crofton: CpD2. For Nora part, see Nora series.	>10	0–60	Silt loam	ML or CL	A–4 or A–6	100	100	90–100	75–100
Davis: Da	[1]>5	0–55	Loam	ML or CL	A–4 or A–6	100	95–100	85–95	60–75
		55–60	Fine sandy loam	ML or SM	A–4	100	95–100	70–85	40–55
*Delmont: De, DeB, DgB, DkB. For Graceville part of DgB, see Graceville series; for Talmo part of DkB, see Talmo series.	>5	0–14	Loam	ML or CL	A–4 or A–6	95–100	85–98	80–95	60–80
		14–60	Sand and gravel	SM, SP, GM, or SM–GM	A–1 or A–2	40–75	20–50	15–30	5–20
Dempster: DmA, DmB	>5	0–15	Silt loam	ML or CL	A–4 or A–6	100	95–100	90–100	70–90
		15–32	Silt loam	CL	A–6	100	95–100	90–100	70–90
		32–60	Sand and gravel	SP, SM, GM, or SM–SC	A–1 or A–2	40–80	30–70	20–50	5–25
*Egan: EaB, EcB, EsB, EsC, EwB. For Chancellor part of EcB, see Chancellor series; for Shindler part of EsB, and EsC, see Shindler series; for Worthing part of EwB, see Worthing series.	>5	0–15	Silty clay loam	ML–CL or CL	A–7 or A–6	100	100	90–100	85–100
		15–30	Silty clay loam	CL	A–7	100	95–100	85–100	70–100
		30–60	Clay loam	CL	A–6 or A–7	100	95–100	85–100	70–90
Graceville: Gr	>5	0–32	Silty clay loam	CL	A–7 or A–6	100	100	95–100	85–95
		32–47	Silty clay loam	CL	A–7 or A–6	100	95–100	90–100	85–95
		47–60	Sand and gravel	SP, SM, GM, or SM–SC	A–1 or A–2	40–80	30–70	20–50	10–30
Huntimer: HuA	>5	0–19	Silty clay loam	CL or CH	A–7	100	100	95–100	85–100
		19–34	Silty clay	CH or MH	A–7	100	100	95–100	90–100
		34–60	Silty clay loam	CL or CH	A–7 or A–6	100	100	95–100	85–100
Lamo: La	[1]2–8	0–60	Silty clay loam	CL, CH, or MH	A–7	100	100	95–100	85–95

significant to engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the this table. The symbol < means less than; the symbol > means more than]

Liquid limit	Plasticity index	Permea-ability	Available water capacity	Reaction	Sal-inity	Shrink-swell potential	Corrosivity: Uncoated steel	Corrosivity: Concrete
Pct		*In per hour*	*In per in of soil*	*pH*	*Mmhos per cm*			
25–40	5–22	0.6–2.0	0.19–0.22	6.6–7.3	<2	Low or moderate	Moderate	Low.
30–50	11–25	0.6–2.0	0.17–0.20	7.4–8.4	<2	Low or moderate	Moderate	Low.
15–38	5–15	0.6–2.0	0.18–0.20	6.6–8.4	<2	Low	Moderate	Low.
10–28	NP–10	0.6–2.0	0.14–0.17	7.4–8.4	<2	Low	Moderate	Low.
<20	NP–10	2.0–6.0	0.12–0.15	7.4–8.4	<2	Low	Moderate	Low.
35–50	15–33	0.06–0.2	0.19–0.22	6.6–7.3	<2	Moderate or high	High	Low.
40–56	15–33	0.06–0.2	0.13–0.18	7.4–7.8	<2	High	High	Low.
40–56	15–33	0.06–0.2	0.14–0.17	7.9–8.4	2–4	High	High	Moderate.
35–56	11–33	0.2–0.6	0.16–0.19	6.6–7.3	<2	High	High	Moderate.
41–74	16–40	0.06–0.2	0.13–0.18	7.9–8.4	2–4	High	High	Moderate.
25–40	5–22	0.6–2.0	0.17–0.20	7.4–8.4	<2	Low or moderate	Moderate	Low.
25–40	5–22	0.6–2.0	0.18–0.20	6.1–7.3	<2	Low	Moderate	Low.
10–28	NP–10	2.0–6.0	0.12–0.15	6.6–8.4	<2	Low	Moderate	Low.
18–38	5–19	0.6–2.0	0.18–0.20	6.6–7.3	<2	Low	Moderate	Low.
5–20	NP–10	6.0–20.0	0.03–0.06	6.6–7.8	<2	Low	Moderate	Low.
25–40	5–19	0.6–2.0	0.19–0.22	6.1–7.3	<2	Low or moderate	Moderate	Low.
25–40	11–22	0.6–2.0	0.17–0.20	6.6–7.8	<2	Moderate	Moderate	Low.
5–20	NP–10	6.0–20.0	0.03–0.06	6.6–7.8	<2	Low	Moderate	Low.
26–50	7–33	0.6–2.0	0.19–0.22	6.1–7.3	<2	Moderate	Moderate	Low.
41–50	11–33	0.6–2.0	0.17–0.20	6.6–8.4	<2	Moderate	Moderate	Low.
25–50	11–35	0.2–0.6	0.17–0.20	7.9–8.4	2–4	Moderate	High	Moderate.
26–50	11–33	0.6–2.0	0.19–0.22	6.1–7.3	<2	Moderate	Moderate	Low.
26–50	11–33	0.6–2.0	0.17–0.20	6.1–7.3	<2	Moderate	Moderate	Moderate.
<20	NP–10	6.0–20.0	0.03–0.06	6.6–7.8	<2	Low	Moderate	Moderate.
41–56	11–35	0.06–0.2	0.16–0.19	6.6–7.3	<2	High	High	Low.
50–74	22–50	0.06–0.2	0.11–0.16	6.6–8.4	<2	High	High	Low.
26–56	11–33	0.06–0.6	0.14–0.17	7.4–8.4	2–4	Moderate or high	High	Low.
41–56	11–33	0.2–0.6	0.19–0.22	7.4–8.4	2–4	High	High	Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Dominant USDA texture	Classification		Percentage less than 3 inches passing sieve—			
				Unified	AASHO	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)
	Ft	*In*							
Luton: Lu	[1]2–8	0–48	Silty clay	CH or MH	A–7	100	100	90–100	90–100
		48–60	Silty clay	CH or MH	A–7	100	100	90–100	85–95
Marsh: Mh. No valid estimates can be made.									
*Moody: MoA, MoB, MpB, MpC2. For Nora part of MpB and MpC2, see Nora series.	>5	0–10	Silty clay loam	CL	A–6 or A–7	100	100	95–100	85–100
		10–28	Silty clay loam	CL	A–6 or A–7	100	100	95–100	85–100
		28–60	Silt loam	ML or CL	A–6 or A–4	100	100	90–100	70–95
Nora. Mapped only in complex with Crofton and Moody soils.	>10	0–7	Silty clay loam	CL	A–6 or A–7	100	100	95–100	80–95
		7–22	Silt loam	ML or CL	A–6 or A–7	100	100	90–100	70–90
		22–60	Silt loam	ML or CL	A–6 or A–4	100	100	90–100	70–90
Renner. Mapped only in complex with Shindler soils.	>5	0–18	Loam	ML–CL or CL	A–6 or A–4	95–100	95–100	85–95	60–75
		18–29	Clay loam	CL	A–6 or A–7	95–100	95–100	85–95	70–80
		29–46	Clay loam	CL	A–6 or A–7	95–100	95–100	85–95	70–80
		46–60	Clay loam	CL	A–6 or A–7	95–100	95–100	85–95	70–80
Salmo: Sa	[1]0–2	0–50	Silty clay loam	CL or ML–CL	A–6 or A–7	100	100	90–100	70–90
		50–60	Silty clay loam	CL or ML–CL	A–6 or A–7	100	100	90–100	70–90
*Shindler: ShD, ShF, SkD2, SmF, StD. For Egan part of SkD2, see Egan series; for Renner part of SmF, see Renner series; for Talmo part of StD, see Talmo series.	>10	0–11	Clay loam	CL	A–6 or A–7	95–100	95–100	90–100	70–85
		11–60	Clay loam	CL	A–6 or A–7	95–100	95–100	80–100	60–85
*Steinauer: SuF. For Shindler part, see Shindler series.	>10	0–24	Clay loam	CL	A–6 or A–7	95–100	95–100	90–100	70–85
		24–60	Clay loam	CL	A–6 or A–7	95–100	95–100	90–100	70–80
Talmo. Mapped only in complex with Delmont and Shindler soils.	>10	0–8	Gravelly loam	ML or CL	A–4 or A–6	80–95	75–85	60–75	50–60
		8–60	Sand and gravel	GM, GC, SC, or SW–SM	A–1 or A–2	40–80	30–70	20–50	15–30
Tetonka: Te	2–8	0–19	Silty clay loam, silt loam.	ML–CL or CL	A–6 or A–7	100	100	90–100	85–100
		19–41	Silty clay	CH or MH	A–7	100	100	90–100	90–100
		41–60	Clay loam	CL	A–7 or A–6	95–100	90–100	80–95	60–90
Thurman: ThB, ThC	>5	0–12	Fine sandy loam	SM or ML	A–2 or A–4	100	100	70–85	30–55
		12–44	Loamy fine sand	SM	A–2	100	90–100	60–85	15–35
		44–60	Fine sand	SM	A–2	100	90–100	50–80	10–30
Viborg. Mapped only in complex with Chancellor soils.	5–10	0–23	Silty clay loam	CL	A–6 or A–7	100	100	95–100	85–95
		23–34	Silty clay loam	CL	A–6 or A–7	100	100	95–100	85–95
		34–60	Clay loam	CL	A–6 or A–7	100	100	90–100	70–80
Wakonda. Mapped only in complex with Chancellor soils.	3–5	0–10	Silt loam	ML or CL	A–6	100	100	90–100	85–100
		10–60	Silt loam, silty clay loam.	CL	A–6 or A–7	100	95–100	90–100	70–95

significant to engineering—Continued

Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity: Uncoated steel	Corrosivity: Concrete
Pct		*In per hour*	*In per in of soil*	*pH*	*Mmhos per cm*			
50–74	22–50	<0.6	0.10–0.14	6.6–7.8	<2	High	High	Low.
50–74	22–50	<0.6	0.08–0.12	7.4–8.4	2–4	High	High	Low.
26–50	11–33	0.6–2.0	0.19–0.22	6.1–7.3	<2	Moderate	Moderate	Low.
26–50	11–33	0.6–2.0	0.17–0.20	6.6–7.3	<2	Moderate	Moderate	Low.
25–40	5–22	0.6–2.0	0.17–0.20	7.4–8.4	<2	Low or moderate	Moderate	Low.
26–50	11–33	0.6–2.0	0.19–0.22	6.6–7.3	<2	Low or moderate	Moderate	Low.
26–50	11–33	0.6–2.0	0.17–0.20	6.6–7.8	<2	Low or moderate	Moderate	Low.
25–40	5–22	0.6–2.0	0.17–0.20	7.4–8.4	<2	Low or moderate	Moderate	Low.
25–38	5–19	0.6–2.0	0.18–0.20	6.1–6.6	<2	Low	Moderate	Low.
30–45	11–25	0.6–2.0	0.19–0.22	6.1–6.6	<2	Moderate	High	Low.
30–45	11–25	0.6–2.0	0.17–0.20	6.1–7.3	<2	Moderate	High	Low.
30–45	11–25	0.2–0.6	0.17–0.20	7.4–8.4	2–4	Moderate	High	Moderate.
30–50	11–25	0.2–0.6	0.16–0.19	7.4–8.4	4–12	Moderate	High	High.
30–50	11–25	0.2–0.6	0.14–0.17	7.4–8.4	4–12	Moderate	High	High.
25–50	10–25	0.6–2.0	0.19–0.22	6.6–7.8	<2	Moderate	Moderate	Moderate.
25–50	10–25	0.2–0.6	0.17–0.20	7.4–8.4	2–4	Moderate	Moderate or high.	Moderate.
25–50	10–25	0.6–2.0	0.17–0.20	7.4–8.4	2–4	Moderate	Moderate	Moderate.
25–50	10–25	0.2–0.6	0.17–0.20	7.4–8.4	2–4	Moderate	Moderate or high.	Moderate.
15–38	5–15	0.6–2.0	0.11–0.15	6.6–8.4	<2	Low	Moderate	Low.
<20	NP–10	6.0–20.0	0.03–0.06	7.4–8.4	<2	Low	Moderate	Low.
26–40	7–20	0.6–2.0	0.19–0.22	6.6–7.3	<2	Moderate	Moderate	Moderate.
50–74	20–45	<0.06	0.10–0.14	6.6–7.8	<2	High	High	Moderate.
30–50	11–25	0.06–0.2	0.14–0.17	7.9–8.4	2–4	High	High	Moderate.
10–28	NP–10	2.0–6.0	0.14–0.17	6.6–7.3	<2	Low	Low	Low.
<20	NP–10	6.0–20.0	0.08–0.10	6.6–7.8	<2	Low	Low	Low.
<20	NP–10	6.0–20.0	0.06–0.08	7.4–8.4	<2	Low	Low	Low.
30–50	11–33	0.6–2.0	0.19–0.22	6.1–7.3	<2	Moderate	High	Low.
30–50	11–33	0.6–2.0	0.17–0.20	6.6–8.4	<2	Moderate	High	Low.
25–50	11–35	0.2–0.6	0.17–0.20	7.4–8.4	2–4	Moderate	High	Moderate.
25–40	11–22	0.6–2.0	0.19–0.22	7.4–8.4	2–4	Moderate	High	Moderate.
26–50	11–25	0.6–2.0	0.14–0.17	7.9–8.4	4–10	Moderate	High	Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Dominant USDA texture	Classification		Percentage less than 3 inches passing sieve—			
				Unified	AASHO	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)
	Ft	*In*							
*Wentworth: WeA, WhA. For Chancellor part of WhA, see Chancellor series.	>5	0–13	Silty clay loam	CL	A–7	100	100	90–100	85–95
		13–60	Silty clay loam	ML–CL or CL	A–7 or A–6	100	100	90–100	85–95
Worthing: Ws	0–5	0–10	Silty clay	CH or CL	A–7	100	98–100	95–100	85–95
		10–60	Silty clay	CH or CL	A–7	100	95–100	85–100	70–95

[1] Subject to flooding.

soil permeability, depth to water table, hazard of flooding, stoniness, and soil slope. The soil material between depths of 18 inches and 6 feet is evaluated.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. Properties or features that affect the rating for this use are permeability, depth to water table, hazard of flooding, organic matter, and soil slope. Soil properties that affect the embankment also are important.

Shallow excavations extend to a depth of 6 feet for basements, ditches, graves, sewerlines, and underground cables and pipelines. The ratings are based on soil texture, depth to water table, hazard of flooding, stoniness, and soil slope.

Dwellings, as rated in table 5, are no more than three stories high and are supported by foundation footings placed in undisturbed soil. Soil properties that affect the rating of a soil for dwellings are depth to water table, hazard of flooding, shrink-swell potential, texture, plasticity, potential frost action, and soil slope.

Sanitary landfill is a method of disposing of refuse in dug trenches by spreading the waste in thin layers, compacting it to the smallest volume, and covering it with soil throughout the disposal period. The ease of excavation, hazard of polluting ground water, and trafficability of the soil affect the suitability for landfill. Soil properties that affect the rating of a soil for landfill are depth to water table, soil drainage, flooding, permeability, slope, texture, and stoniness. The ratings are valid only to a depth of 6 feet.

Local roads and streets, as rated in table 5, have an all-weather surface expected to carry automobile traffic all year. Soil properties that affect design and construction are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of soil material, shrink-swell potential, wetness, slope, and stoniness are properties that affect the rating.

Road fill is soil material used in road embankments. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

The suitability ratings for sand and gravel provide guidance about where to look for probable sources. The ratings do not take into account thickness of overburden, depth to water table, or other factors that affect mining of the material, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Soil texture, thickness of suitable layers, natural fertility, stoniness, and absence of substances toxic to plants affect suitability.

Pond reservoir areas are affected by seepage loss of water, as indicated by permeability of the subsoil and substratum. Soil slope affects the storage potential of the pond site.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility.

Drainage for crops and pasture is affected by such soil properties as permeability, depth to water table, slope, stability, flooding, salinity, and availability of outlets for drainage.

Irrigation of a soil is affected by such properties and features as slope, water intake rate, available water capacity, permeability, need for drainage, salinity, and erodibility.

Terraces and diversions are embankments or ridges constructed across the slope to intercept runoff. Soil features that affect suitability for terraces and diversions are uniformity and steepness of slopes, depth to unfavorable material, permeability, and erodibility. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Engineering test data

Tables 6 and 7 contain engineering test data for some of the soil series in Lincoln County. The tests were made by the South Dakota Department of Highways in accordance with standard procedures of the American

significant to engineering—Continued

Liquid limit	Plasticity index	Permea-bility	Available water capacity	Reaction	Sal-inity	Shrink-swell potential	Corrosivity	
							Uncoated steel	Concrete
Pct		*In per hour*	*In per in of soil*	*pH*	*Mmhos per cm*			
41–50	11–25	0.6–2.0	0.19–0.22	6.1–7.3	<2	Moderate	Moderate	Low.
26–50	11–25	0.6–2.0	0.17–0.20	6.6–8.4	2–4	Moderate	High	Low.
41–74	16–40	0.2–0.6	0.13–0.18	6.1–7.3	<2	High	High	Low.
41–74	16–40	0.06–0.2	0.13–0.18	6.6–8.4	2–4	High	High	Low.

Association of State Highway Officials. Table 6 shows the results of tests on selected horizons of five soils at specific locations in Lincoln County. Table 7 summarizes the tests made on soil samples collected along proposed highway routes in this and adjacent counties.

In table 7, the horizon column indicates the major horizons from which samples were taken. The samples were taken at depths that indicated distinct contrasts in color and texture and, therefore, may include material from more than one major horizon. The number of samples taken for each horizon also is shown. The actual range and average value for each of the several properties are given; but because of the method of sampling, the range in properties shown in table 7 may differ from the range shown in table 4.

Some of the columns in tables 6 and 7 not previously explained for table 4 are explained in the following paragraphs.

Maximum dry density is the maximum unit dry weight of a soil when compacted with optimum moisture by the prescribed method of compaction. The moisture content that gives the highest dry unit weight is the *optimum moisture* content for the specific method of compaction.

Mechanical analyses show the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarse particles do not pass through the No. 200 sieve, but silt and clay do. Percentages of fractions smaller than those passing the No. 200 sieve were determined by the hydrometer method, rather than by the pipette method that most soil scientists use in determining the clay content of soil samples.

California bearing ratio (CBR) expresses the load-supporting capacity of a soil as compared to that of standard crushed limestone. The estimated values shown in table 7 have a relationship to liquid limit. Generally, the soils that have a high liquid limit have a low CBR value.

Town and country planning

Information about soils is important in the planning of sites and developing of land for nonfarm uses. Land appraisers, realtors, city planners, builders, and others need facts that help them to determine what soils are suitable for homes and other buildings and what areas are better suited to other uses. This information is obtained by using the soil maps in this survey to identify the soils and then referring to the sections "Descriptions of the Soils" and "Engineering Uses of the Soils." It should be emphasized, however, that it is desirable to make detailed sampling and testing at the exact site of proposed installations.

Soil properties have an important effect on the suitability of a site for a subdivision or for an individual home. Table 4 lists for each soil in the county the estimated properties significant in engineering. It also places the soils in the Unified Classification system and, thus, groups the soils in respect to their performance as construction and foundation material. Generally, GW, GM, GC, SW, SM, and SC groups have slight limitations as construction material; ML and CL groups have moderate limitations; and CH and MH groups have severe limitations.

Table 5 provides engineering interpretations of soils that are useful for planning the installation of septic tank absorption fields, sewage lagoons, and shallow excavations for various purposes and for locating sites for dwellings and other low buildings and sites for sanitary land fill and for roads and streets.

Erosion is a serious hazard on sloping soils in construction areas. Exposed cuts, paving, and compaction of soil material during construction increase runoff several times more than expected when the same soil is used for crops and pasture. The concentration of runoff in streets and gutters results in flooding and deposition of sediment in low areas below the construction area.

Soil properties are important for planning recreation uses, such as athletic areas, campsites, golf courses, picnic areas, playground areas, and paths and trails. Nearly level and gently sloping soils that have adequate drainage and have favorable surface textures and favorable foot traffic qualities are well suited. Desirable sites also are free of stones and are not subject to flooding during the season of use. The section

TABLE 5.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The the instructions for referring to other series

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill [1]	Local roads and streets
*Alcester: AcA, AcB, Af, Ah. For Lamo part of Ah, see Lamo series.	Moderate to severe: moderate permeability; subject to flooding in some areas.	Moderate to severe: moderate permeability; subject to flooding in some areas.	Moderate to severe: moderately well drained; subject to flooding in some areas.	Moderate to severe: subject to flooding in some areas; low or moderate shrink-swell potential.	Moderate to severe: moderately well drained; subject to flooding in some areas.	Severe: high susceptibility to frost action.
Bon: Bo	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; moderately rapid permeability in substratum.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.
*Chancellor: Ca, Cd; Ch. For Tetonka part of Ca and Ch, see Tetonka series; for Viborg part of Cd, see Viborg series; for Wakonda part of Ch, see Wakonda series.	Severe: slow permeability; seasonal high water table; subject to flooding.	Generally severe: subject to flooding; seasonal high water table. Slight if water does not enter or damage lagoon.	Severe: somewhat poorly drained; subject to flooding.	Severe: high shrink-swell potential; somewhat poorly drained; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: high shrink-swell potential.
Clamo: Co	Severe: subject to flooding; slow permeability; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Severe: poorly drained.	Severe: high shrink-swell potential; poorly drained.	Severe: poorly drained.	Severe: poorly drained; high shrink-swell potential.
*Crofton: CpD2. For Nora part, see Nora series.	Moderate: strongly sloping; moderate permeability.	Severe: strongly sloping.	Moderate: strongly sloping.	Moderate: strongly sloping.	Slight for trench type. Moderate for area type where slopes are 8 to 15 percent.	Moderate where slopes are 8 to 15 percent.
Davis: Da	Moderate to severe: moderate permeability; subject to flooding in some areas.	Moderate to severe: moderate permeability; subject to flooding in some areas.	Moderate to severe: moderately well drained; subject to flooding in some areas.	Moderate to severe: moderately well drained; subject to flooding in some areas.	Moderate to severe: moderately well drained; subject to flooding in some areas.	Moderate to severe: moderate susceptibility to frost action; subject to flooding in some areas.

interpretations of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully that appear in the first column of this table]

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pastures	Irrigation	Terraces and diversions
Poor: high susceptibility to frost action.	Unsuited	Fair: silty clay loam texture.	Moderate permeability; slopes of 0 to 6 percent.	Fair to poor stability and compaction characteristics.	Moderate permeability; receives some overflow.	Receives some local overflow; moderate intake rate; high available water capacity.	Concave slopes of 0 to 6 percent; moderate permeability; high siltation hazard.
Fair: moderate susceptibility to frost action.	Unsuited	Good: friable loam; high fertility.	Moderately rapid permeability in substratum.	Poor stability and compaction characteristics; moderate permeability when compacted.	Subject to flooding; seasonal high water table; moderate permeability.	Subject to flooding; high water table; high available water capacity; moderately slow intake rate.	Subject to flooding; moderately rapid permeability in substratum.
Poor: high shrink-swell potential.	Unsuited	Fair: silty clay loam texture.	Seasonal high water table; slow permeability.	Fair to poor stability and compaction characteristics; high shrink-swell potential.	Low relief; wet areas; slow permeability.	Slow intake rate; subject to flooding; high available water capacity.	Not applicable.
Poor: high shrink-swell potential; poorly drained.	Unsuited	Poor: poorly drained.	Seasonal high water table; sand below a depth of 60 inches in places.	Fair to poor stability and compaction characteristics.	Subject to flooding; seasonal high water table; slow permeability.	Poorly drained.	Not applicable.
Fair: moderate susceptibility to frost action; medium compressibility.	Unsuited	Fair: thin surface layer; low fertility; excess lime.	Moderate permeability.	Poor stability and compaction characteristics.	Well drained; moderate permeability.	Strongly sloping.	Strongly sloping; severe erosion hazard.
Fair: moderate susceptibility to frost action.	Unsuited	Good: friable loam; high fertility.	Moderate permeability.	Fair to poor stability.	Moderately well drained; moderate permeability.	Some areas subject to flooding; high available water capacity; moderately slow intake rate.	Slopes of 0 to 2 percent; generally not applicable.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill [1]	Local roads and streets
*Delmont: DeA, DeB, DgB, DkB. For Graceville part of DgB, see Graceville series; for Talmo part of DkB, see Talmo series.	Slight [2]	Severe: rapid permeability in substratum.[2]	Severe: loose sand and gravel below a depth of 14 inches.	Slight	Severe: rapid permeability in substratum.[2]	Slight
Dempster: DmA DmB	Slight [2]	Severe: rapid permeability in substratum.[2]	Moderate: loose sand and gravel at a depth of 32 inches.	Slight	Severe: rapid permeability below a depth of 32 inches.[2]	Moderate: moderate shrink-swell potential to a depth of 32 inches.
*Egan: EaB, EcB, EsB, EsC, EwB. For Chancellor part of EcB, see Chancellor series; for Shindler part of EsB and EsC, see Shindler series; for Worthing part of EwB, see Worthing series.	Severe: moderately slow permeability at a depth of 30 inches.	Moderate where slopes are 2 to 6 percent. Severe where slopes are more than 6 percent.	Moderate: clay loam texture below a depth of 30 inches.	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam and clay loam texture.	Severe: high susceptibility to frost action.
Graceville: Gr	Moderate to severe: moderate permeability; subject to flooding in some areas.[2]	Severe: subject to flooding in some areas; rapid permeability below a depth of 47 inches.[2]	Moderate: loose sand and gravel below a depth of 47 inches; subject to flooding in some areas.	Moderate to severe: moderate shrink-swell potential; subject to flooding in some areas.	Severe: subject to flooding in some areas; rapid permeability below a depth of 47 inches.[2]	Severe: high susceptibility to frost action.
Huntimer: HuA	Severe: slow permeability.	Slight	Severe: silty clay subsoil.	Severe: high shrink-swell potential.	Severe: silty clay and silty clay loam texture.	Severe: CH or CL material; high shrink-swell potential.
Lamo: La	Severe: subject to flooding; seasonal high water table; moderately slow permeability.	Severe: subject to flooding; seasonal high water table.	Severe: somewhat poorly drained; subject to flooding.	Severe: somewhat poorly drained; subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table; high susceptibility to frost action.

of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pastures	Irrigation	Terraces and diversions
Good	Good to fair: some fines.	Fair: friable loam; sand and gravel at a depth of 14 inches.	Rapid permeability below a depth of 14 inches.	Fair to good stability and compaction characteristics; high permeability when compacted.	Rapid permeability below a depth of 14 inches.	Rapid intake rate; low available water capacity.	Shallow to sand and gravel.
Fair to good: moderate shrink-swell potential to a depth of 32 inches.	Good to fair: sand and gravel at a depth of 32 inches; some fines.	Good: friable silt loam.	Rapid permeability below a depth of 32 inches.	Fair to good stability and compaction characteristics; high permeability below a depth of 32 inches when compacted.	Moderate permeability to a depth of 32 inches; rapid below.	Moderate available water capacity; moderate intake rate.	Moderately deep to sand and gravel.
Poor: high shrink-swell potential; frost action.	Unsuited	Fair: silty clay loam texture.	Moderately slow permeability below a depth of 30 inches.	Fair to good stability and compaction characteristics.	Well drained; moderately slow permeability below a depth of 30 inches.	Slopes of 2 to 15 percent; slow intake rate; high available water capacity.	Short and irregular slopes in places; moderately slow permeability below a depth of 30 inches.
Poor to a depth of 47 inches: high susceptibility to frost action. Good below a depth of 47 inches.	Fair to good below a depth of 47 inches.	Fair: silty clay loam texture.	Rapid permeability below a depth of 47 inches.	Fair to good stability and compaction characteristics; high permeability below a depth of 47 inches when compacted.	Moderate permeability to a depth of 47 inches, rapid below a depth of 47 inches; subject to flooding in some areas.	High available water capacity; moderately slow intake rate; good drainage in substratum.	Rapid permeability below a depth of 47 inches.
Poor: CH or CL material; high shrink-swell potential.	Unsuited	Fair: silty clay loam texture.	Nearly level; slow permeability.	Fair to poor stability and compaction characteristics.	Slow permeability; well drained.	Very slow intake rate; moderate or high available water capacity.	Slopes of 0 to 2 percent; slow permeability.
Poor: high susceptibility to frost action; CL material; high plasticity.	Unsuited	Fair: silty clay loam texture.	Seasonal high water table; layers of sand below a depth of 40 inches in places.	Fair stability and compaction characteristics.	Subject to flooding; seasonal high water table; moderately slow permeability.	Subject to flooding; seasonal high water table; slow intake rate; high available water capacity.	Nearly level; moderately slow permeability.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill [1]	Local roads and streets
Luton: Lu	Severe: very slow permeability.	Severe: subject to flooding; Slight if protected from flooding.	Severe: poorly drained; silty clay.	Severe: high shrink-swell potential; poorly drained.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; high shrink-swell potential.
Marsh: Mh	Severe: very wet; frequently ponded.	Severe: frequently ponded.	Severe: frequently ponded.	Severe: very wet; frequently ponded.	Severe: very wet; frequently ponded.	Severe: very wet; frequently ponded.
*Moody: MoA, MoB, MpB, MpC2. For Nora part of MpB and MpC2, see Nora series.	Moderate: moderate permeability.	Moderate: moderate permeability. Severe where slopes are more than 6 percent.	Slight	Slight to moderate: low or moderate shrink-swell potential below a depth of 28 inches.	Slight	Severe: high susceptibility to frost action.
Nora. Mapped only in complex with Crofton and Moody soils.	Moderate: moderate permeability.	Moderate: moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are more than 8 percent.	Slight to moderate: low or moderate shrink-swell potential.	Slight	Severe: high susceptibility to frost action.
Renner. Mapped only in complex with Shindler soils.	Severe: moderately slow permeability in substratum.	Severe: slopes of more than 7 percent in most places.	Moderate: clay loam texture below a depth of 18 inches. Severe where slopes are more than 15 percent.	Moderate to severe: slopes of more than 8 percent in most places.	Moderate: clay loam texture below a depth of 18 inches.	Severe: CL material; high plasticity.
Salmo: Sa	Severe: subject to flooding; seasonal high water table; moderately slow permeability.	Severe: subject to flooding; seasonal high water table.	Severe: very poorly drained; subject to flooding.	Severe: very poorly drained; subject to flooding.	Severe: very poorly drained; subject to flooding.	Severe: very poorly drained; subject to flooding.
*Shindler: ShD, ShF, SkD2, SmF, StD. For Egan part of SkD2, see Egan series; for Renner part of SmF, see Renner series; for Talmo part of StD, see Talmo series.	Severe: moderately slow permeability in substratum; slopes of more than 15 percent in places.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Moderate to severe: clay loam texture. Severe where slopes are more than 15 percent.	Moderate to severe: moderate susceptibility to frost action; moderate shrink-swell potential. Severe where slopes are more than 15 percent.	Moderate to severe: clay loam texture. Severe where slopes are more than 25 percent.	Severe: CL material; high plasticity.

of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pastures	Irrigation	Terraces and diversions
Poor: high shrink-swell potential; poorly drained.	Unsuited	Poor: silty clay texture.	Seasonal high water table; very slow permeability; layers of sand below a depth of 40 inches in places.	Low shear strength; fair to poor stability and compaction characteristics.	Subject to flooding; high water table; very slow permeability.	Very slow intake rate; subject to flooding; seasonal high water table; low or moderate available water capacity.	Not applicable.
Poor: very poorly drained.	Unsuited	Poor: common ponded areas.	Features favorable, but construction difficult.	Very wet in places.	Very wet in places; outlets generally not available.	Not applicable.	Not applicable.
Poor: high susceptibility to frost action.	Unsuited	Fair: silty clay loam texture.	Moderate permeability; slopes of 0 to 10 percent.	Fair stability and compaction characteristics.	Moderate permeability; well drained.	Moderately slow intake rate; high available water capacity.	Long slopes of 0 to 10 percent; erodible.
Poor: high susceptibility to frost action.	Unsuited	Fair: silty clay loam surface layer.	Moderate permeability; slopes of 2 to 17 percent.	Poor stability and compaction characteristics.	Moderate permeability; well drained.	Slope; erodible; moderately slow intake rate; high available water capacity.	Long slopes of 2 to 17 percent; erodible; low fertility in shaped channels.
Poor: CL material; high plasticity.	Unsuited	Good: friable loam; high fertility.	Moderately slow permeability in substratum; pockets of sand below a depth of 40 inches in places.	Fair to good stability and compaction characteristics.	Well drained; moderately slow permeability below a depth of 46 inches.	Not applicable.	Short, concave slopes; moderate permeability.
Poor: very poorly drained.	Unsuited	Poor: high salt content; very poorly drained.	High water table; layers of sand below a depth of 40 inches in places; high salt content.	Poor stability and compaction characteristics.	Very poorly drained; moderately slow permeability.	Seasonal high water table; subject to flooding; high salt content.	Not applicable.
Poor: CL material; high plasticity.	Unsuited	Fair: clay loam texture. Poor where slopes are more than 15 percent.	Gently undulating to steep; pockets of sand below a depth of 40 inches in places.	Moderate shrink-swell potential; fair stability; low permeability when compacted.	Well drained; moderately slow permeability below a depth of 11 inches.	Slopes of 2 to 40 percent; high available water capacity; moderately slow intake rate.	Short, convex slopes of 2 to 40 percent; clay loam texture.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill [1]	Local roads and streets
*Steinauer: SuF. For Shindler part, see Shindler series.	Severe: steep.	Severe: steep.	Severe: steep.	Severe: steep.	Severe: steep.	Severe: steep.
Talmo. Mapped only in complex with Delmont and Shindler soils.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: rapid permeability.[2]	Severe: loose sand and gravel.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: rapid permeability.[2]	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
Tetonka: To	Severe: very slow permeability.	Severe: seasonal high water table; subject to ponding. Slight if protected from flooding.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: high shrink-swell potential; poorly drained.
Thurman: ThB, ThC	Slight [2]	Severe: rapid permeability.[2]	Severe: loamy fine sand below a depth of 12 inches.	Slight	Severe: rapid permeability.[2]	Slight
Viborg. Mapped only in complex with Chancellor soils.	Severe: moderately slow permeability in substratum.	Slight	Moderate to severe: moderately well drained. Severe if not protected from flooding.	Moderate to severe: subject to flooding in some areas.	Moderate to severe: moderately well drained; subject to flooding.	Severe: high susceptibility to frost action.
Wakonda. Mapped only in complex with Chancellor soils.	Severe: seasonal high water table at a depth of 3 to 5 feet.	Moderate: seasonal high water table; moderate permeability.	Moderate: moderately well drained.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: high susceptibility to frost action.

of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pastures	Irrigation	Terraces and diversions
Poor: steep	Unsuited	Poor: thin surface layer; low fertility; slope.	Steep	Moderate shrink-swell potential; fair to poor stability and compaction characteristics.	Well drained	Steep; not applicable.	Steep; erodible.
Good: few cobbles in places. Fair where slopes are more than 15 percent.	Good	Poor: coarse fragments; thin surface layer.	Very high seepage rate.	Fair to good stability and compaction characteristics; seepage.	Rapid permeability; excessively drained.	Very rapid intake rate; low or very low available water capacity.	Very shallow to sand and gravel.
Poor: high shrink-swell potential; poorly drained.	Unsuited	Poor: poorly drained.	Low seepage rate; ponding; good dugout site.	High shrink-swell potential; fair to poor stability and compaction characteristics.	Low relief; wet areas; very slow permeability.	Poorly drained; very slow intake rate.	Not applicable.
Good	Fair: poorly graded; some fines.	Good to a depth of 12 inches. Poor below a depth of 12 inches.	Rapid permeability.	Poor resistance to piping; poor to fair stability.	Rapid permeability.	Rapid intake rate; low or moderate available water capacity; hazard of soil blowing.	Hazard of soil blowing; rapid permeability.
Poor: CL material; plasticity index more than 15.	Unsuited	Fair: silty clay loam texture.	Nearly level; moderately slow permeability below a depth of 34 inches.	Moderate shrink-swell potential; fair to good stability and compaction characteristics.	Moderately well drained; moderately slow permeability in substratum.	Moderately well drained; moderately slow intake rate; high available water capacity.	Not applicable.
Poor: seasonal high water table; high susceptibility to frost action.	Unsuited	Fair: high lime content below a depth of 10 inches.	Moderate permeability; seasonal high water table.	Fair to good stability and compaction characteristics; medium susceptibility to piping.	Moderately well drained; moderately slow permeability.	Moderately saline below a depth of 10 inches; seasonal high water table; moderately slow intake rate; high available water capacity.	Not applicable.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill [1]	Local roads and streets
*Wentworth: WeA, WhA. For Chancellor part of WhA, see Chancellor series.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam texture.	Severe: high susceptibility to frost action.
Worthing: Ws	Severe: slow permeability; subject to flooding.	Severe: seasonal high water table; subject to flooding. Slight if water does not enter or damage lagoon.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; subject to flooding.

[1] Onsite study of the deep underlying strata, the water table, and the hazards of aquifer pollution and drainage into ground water should be made in landfill deeper than 5 or 6 feet.

"Descriptions of the Soils" gives information on these characteristics of the soils.

Formation and Classification of the Soils

This section consists of two parts. The first part discusses the five factors of soil formation as they relate to the soils of Lincoln County. The second describes the system for classifying soils and places the soil series of this county in the system.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on material deposited or accumulated by geologic forces. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material [7]

Most of the soils in the county formed in material deposited by glacial action. Loess and other windblown deposits and alluvium are other kinds of parent material.

Lincoln County is in a region of repeated glaciation. Four major glacial stages, the Nebraskan, Kansan, Illinoian, and Wisconsin, covered the county during the Pleistocene (*3*). The Iowan and Cary substages of the Wisconsin stage are the deposits in which the soils of Lincoln County formed (*4*). Pre-Iowan glacial material is buried under younger deposits at a depth too great to influence present soil formation. The Iowan deposits are mainly in the southeastern part of the county. The younger Cary material covers much of the remaining part of the county.

Several types of glacial deposits are in the county. Silty drift consists of material deposited on glacial ice. This material was reworked by water and distorted by sliding, and it commonly is stratified with coarser material. The Wakonda and Wentworth soils formed in silty drift. The Egan soils formed in a thin mantle

[7] By JAMES R. MONAGHAN, geologist, Soil Conservation Service.

of the soils—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pastures	Irrigation	Terraces and diversions
Poor: high susceptibility to frost action.	Unsuited	Fair: silty clay loam texture.	Nearly level; moderate permeability.	Moderate shrink-swell potential; fair to poor stability and compaction characteristics.	Moderate permeability; well drained.	Moderately slow intake rate; high available water capacity.	Slopes of 0 to 2 percent.
Poor: high shrink-swell potential.	Unsuited	Poor: poorly drained; silty clay texture.	Slow permeability; subject to flooding.	Fair to poor stability and compaction characteristics.	Low relief; wet areas; slow permeability; outlets generally not available.	Poorly drained; very slow intake rate; moderate or high available water capacity.	Depressional areas subject to ponding; generally not applicable.

[3] Hazard of contaminating nearby water supplies in places.

of silty glacial drift and in the underlying glacial till.

Glacial till is a mixture of clay, silt, sand, and gravel that contains few to many cobbles and boulders. The proportion of each constituent depends on the kinds of material passed over by the glacier. Among the soils formed in glacial till are those of the Renner, Shindler, and Steinauer series.

Deposits in ice-walled lakes during the glacial period produced highly distorted, mixed material that shows evidence of sorting and stratification. The material has a high content of clay and silt and in places is stratified with thin layers of sand and gravel. Soils of the Huntimer series formed in this material.

Outwash sand and gravel consist of material sorted and washed by the melt water of glaciers. Outwash deposits are on high terraces and on till plains near the larger drainageways. The material commonly is difficult to distinguish from younger alluvial deposits. Delmont, Dempster, Graceville, and Talmo soils formed in loamy and silty material overlying outwash sand and gravel.

Loess consists of wind-deposited material that is mainly silt and very fine sand. These deposits are mostly in the southeastern part of the county and range from about 5 feet to more than 20 feet in thickness. Crofton, Moody, and Nora soils formed in loess. Thurman soils formed in predominantly sandy material that has been sorted and reworked by wind.

Alluvium consists of water-deposited material. Soils formed in local alluvium that washed from adjacent upland soils include those of the Alcester, Chancellor, Tetonka, Viborg, and Worthing series. Soils formed in stream-deposited alluvium on flood plains include those of the Bon, Clamo, Lamo, Luton, and Salmo series. Davis soils on low terraces also formed in alluvium.

Climate

Lincoln County has a subhumid climate. It is characterized by a cold winter, a cool spring that has considerable precipitation, a hot summer, and a mild autumn that has only occasional rainy periods. In winter, soil-forming processes are mostly dormant. The soils are frozen to a depth of 2 to 3 feet for 4 to 5 months of the year. The depth to which the frost penetrates depends mostly on the amount of snowfall late in fall or early in winter. Most of the rainfall comes in the first half of the growing season. There is often a period of deficient rainfall late in summer. More climatic data are given in the section "Climate."

Climate, as a soil-forming factor, affects the weathering of parent material through precipitation, fluctuation in temperature, and the work of wind. Large differences in climate can produce large differences in the soils that are formed. However, the climate is fairly uniform throughout Lincoln County, and differences in the soils cannot be attributed to differences in climate alone. The effects of climate are modified by the effects of the other four factors of soil formation.

Plant and animal life

Many living organisms are important in soil formation. These include plants, animals, and microorganisms, such as bacteria and fungi.

The vegetation is generally responsible for the amount of organic matter, the color of the surface layer, and the amount of nutrients. Plant roots pene-

TABLE 6.—*Engineering*

[Tests performed by the South Dakota Department of Highways in accordance with

Soil name and location	Parent material	Report number	Depth	Moisture density [1]	
				Maximum dry density	Optimum moisture
			In	*Lb per cu ft*	*Pct*
Clamo silty clay loam: 252 feet W. and 1,380 feet N. of SE. corner of sec. 26, T. 98 N., R. 49 W. Modal.	Clayey alluvial sediment.	385	8–16	91	25
		386	24–38	99	21
Lamo silty clay loam: 94 feet N. and 715 feet W. of SE. corner of sec. 23, T. 96 N., R. 49 W. Modal.	Silty alluvial deposits.	387	15–32	85	28
Talmo gravelly loam: 1,220 feet W. and 932 feet S. of NE. corner of sec. 5, T. 98 N., R. 49 W. Modal.	Gravelly stream outwash.	397	7–60	107	12
Tetonka silty clay loam: 1,890 feet E. and 182 feet N. of SW. corner of sec. 34, T. 98 N., R. 50 W. Modal.	Local colluvium overlying glacial drift.	390	7–13	96	22
		391	13–19	100	19
		392	19–33	92	24
		393	38–53	105	18
Wakonda silt loam: 147 feet E. and 610 feet N. of SW. corner of sec. 34, T. 98 N., R. 50 W. Modal.	Glacial drift.	388	9–20	100	20
		389	37–45	101	23

[1] Based on AASHO Designation T 99–57, Method A (*1*).

[2] Mechanical analysis according to AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method,

trate the soil, make it porous, and encourage the development of soil structure. The roots take up minerals in solution from the lower parts of the soil and eventually return them to the surface in the form of organic matter.

Animals, such as earthworms, cicada, and burrowing animals, help to keep the soil open and porous. These animals help to mix the humus with the soil. Earthworm activity is very evident in the friable silty and loamy soils, such as those of the Egan and Shindler series, but is less evident in clayey soils, such as those of the Worthing series. Burrowing animals have mixed the soil horizons in some places, but their activities were less important than those of earthworms.

Micro-organisms, such as bacteria and fungi, decompose vegetation, thus releasing nutrients for plant food.

In Lincoln County, mid and tall prairie grasses have had more influence on soil formation than other living organisms. The darkest-colored, most fertile soils generally formed where conditions were most favorable for dense plant growth. Alcester and Viborg soils are examples. The lighter colored and less fertile soils formed where conditions were not favorable for good stands of vegetation, such as on steep, droughty slopes or in sandy material. Steinauer and Talmo soils are examples.

Man has had only a minor influence on soil formation, but he has had a great influence on the potential of the soils to support plants and animals. He has removed the native vegetation from the soil and pulverized the surface layer through plowing and cultivation. He has used inadequate cropping sequences and has failed to control runoff. Consequently, many sloping soils have lost much of their original topsoil through accelerated erosion.

Relief

Relief, or lay of the land, influences the formation of soil through its effect on runoff and drainage, erosion, plant cover, and soil temperature.

Profile development is minimal in the steep Steinauer soils because of rapid runoff. These soils have a thin surface layer, lack a distinct subsoil layer, and are calcareous at the surface. A greater amount of precipitation enters the well-drained, less steep Egan and

test data

standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [3]					Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than 0.005 mm				
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				AASHO [3]	Unified [4]
					Pct			
------------	100	99	96	41	50	19	A-7-5(14)	ML
100	99	98	90	39	46	21	A-7-6(13)	ML-CL
------------	------------	100	89	35	52	19	A-7-5(14)	MH
94	89	44	7	3	16	[5] NP	A-1-6(0)	SW-SM
------------	100	99	96	37	39	15	A-6(10)	ML-CL
------------	100	97	95	31	31	9	A-4(8)	ML-CL
------------	100	99	98	49	62	33	A-7-6(20)	CH
97	94	81	63	40	48	25	A-7-6(12)	CL
------------	100	99	94	43	43	19	A-7-6(12)	ML-CL
100	99	93	72	37	41	18	A-7-6(11)	CL

and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes of soil.

[3] Based on AASHO Designation M 145-49 (*1*).
[4] Based on the Unified soil classification system (*9*).
[5] NP = nonplastic.

Wentworth soils. These soils have a thicker surface layer than Steinauer soils, have a distinct subsoil, and are leached of carbonates to a depth of as much as 32 inches. The moderately well drained Alcester and Viborg soils receive additional moisture in the form of runoff from adjacent soils. As a result, they have a thicker surface layer and subsoil and are leached of carbonates to a greater depth than Egan and Wentworth soils.

Time

The formation of soils requires time for changes to take place in the parent material, and this is usually a long time when measured in years. But soils are "aged" according to the degree of horizon development in the profile. Soils that have little or no development are immature, while those that have well-expressed horizons are mature soils, even though the parent materials in which they formed are the same age.

Generally, the longer the parent material has remained in place, the more fully developed are the horizons in the profile. Because of differences in parent material and relief, however, some profiles develop more slowly than others.

The youngest soils, such as Lamo and Salmo soils, formed in recent alluvium. They remain young because new parent material is deposited periodically by floodwater. The constantly moist condition of these alluvial soils also inhibits the soil-forming processes. Steep soils are likely to be less developed than gently sloping soils. Steep soils, such as Steinauer soils, remain young because soil material is removed by erosion almost as soon as it forms and, consequently, no well-defined horizons develop. These soils, therefore, have been affected only slightly by time.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through classification, and then through

TABLE 7.—*Engineering test data for soil*

[Tests made by the South Dakota Department of Highways.

Soil series	Horizon	Number of samples tested	Mechanical analysis[1]							
			Percentage less than 3 inches passing sieve—						Percentage smaller than 0.005 mm	
			No 10 (2.0 mm)		No 40 (0.42 mm)		No 200 (0.074 mm)			
			Range	Average	Range	Average	Range	Average	Range	Average
Alcester.	A	21	98–100	100	88–100	97	73–100	89	8–33	20
	B	30	98–100	100	93–100	98	84–100	94	10–40	24
	C	23	99–100	100	95–100	98	81–100	93	11–46	28
Chancellor.	A	8	99–100	100	95–99	97	86–95	90	25–48	36
	B	4		100	97–100	99	86–100	95	22–58	40
	C	4	99–100	100	94–100	98	78–100	92	29–71	49
	IIC	3	96–100	98	94–96	95	79–89	84	32–50	41
Clamo.	A	5	96–100	99	83–100	92	56–95	77	9–38	23
	B	30	97–100	99	85–100	96	63–100	87	17–55	36
	C	23	96–100	98	84–100	93	55–100	78	19–62	40
Crofton.	C	41	99–100	100	96–100	99	89–100	97	16–38	26
Davis.	A	12	89–100	96	79–100	90	56–84	70	10–40	25
	B	7	92–100	97	81–100	91	47–96	71	14–37	25
	C	23	94–100	97	84–98	91	57–89	73	23–57	39
Delmont.	A	8	71–100	92	56–100	81	23–78	51	4–27	15
	B	25	78–100	93	54–99	76	16–72	44	3–32	17
	C	7	46–100	74	11–77	44	2–38	20	2–13	7
	IIC	84	40–100	75	14–95	55	0–57	28	0–29	12
Dempster.	B	6	96–100	99	79–100	92	36–100	70	7–47	27
	IIC	12	58–100	86	31–100	69	0–54	27	0–30	11
Egan.	A	46	99–100	100	94–100	97	82–99	90	21–47	34
	B	156	97–100	99	92–100	97	79–100	90	19–54	36
	C	36	80–100	97	71–100	92	52–100	83	13–58	35
	IIC	83	82–100	95	68–100	87	39–96	67	12–52	32
Graceville.	A	4	95–100	99	89–98	94	66–92	79	4–33	18
	B	16	95–100	99	83–100	92	50–99	75	8–37	22
	IIC	17	50–100	80	23–94	58	1–55	28	0–26	10
Lamo.	A	22	95–100	99	89–100	96	64–100	82	15–44	29
	B	48	92–100	98	84–100	94	62–100	83	14–44	29
	C	47	93–100	98	80–100	94	54–100	79	14–51	32
	IIC	4	54–100	83	14–100	60	0–48	22	0–20	9
Luton.	A	10	98–100	100	85–100	94	58–100	80	5–59	31
	B	21	98–100	100	91–100	97	70–100	91	14–72	42
	C	29	98–100	99	82–100	93	57–100	80	3–52	27
	IIC	14	65–100	89	19–100	61	0–40	18	0–15	5
Moody.	A	67	98–100	100	97–100	99	90–100	96	11–45	27
	B	163	98–100	100	95–100	99	86–100	96	16–45	30
	C	105	99–100	100	95–100	99	84–100	95	20–40	29
	IIC	7	89–100	95	82–96	89	56–83	70	14–39	26
Nora.	A	14		100	99–100	99	95–99	97	8–28	18
	B	41	96–100	99	91–100	97	77–100	92	11–38	24
	C	11	98–100	99	89–100	96	67–100	86	16–39	27
	IIC	1		100		97		69		21
Talmo.	A	5	72–100	90	53–100	77	22–89	56	3–32	17
	C	17	25–100	73	0–100	52	0–59	24	0–12	5
	IIC	29	41–100	75	15–93	54	2–48	25	0–22	10

samples taken along proposed highway routes

Dashed lines indicate that soils were not tested for that property]

Liquid limit [3]		Plasticity [3] index		Classification			Estimated California bearing ratio [4]
Range	Average	Range	Average	AASHO [5] (Old index)	AASHO [6] (New index)	Unified [7]	
37–49	43	10–21	15	A–7–6(11)	A–7–6(16)	ML–CL	4
36–49	42	11–23	16	A–7–6(11)	A–7–6(18)	ML–CL	5
32–51	42	10–27	18	A–7–6(12)	A–7–6(19)	CL	5
45–57	51	17–31	24	A–7–6(16)	A–7–6(25)	MH–CH	3
47–61	54	26–33	29	A–7–6(19)	A–7–6(32)	CH	3
38–59	49	19–39	29	A–7–6(17)	A–7–6(29)	CL	3
40–46	43	20–27	23	A–7–6(14)	A–7–6(20)	CL	4
37–58	48	11–28	19	A–7–6(14)	A–7–6(16)	ML–CL	4
39–66	52	16–39	27	A–7–6(18)	A–7–6(26)	CH	3
28–67	48	11–41	25	A–7–6(16)	A–7–6(20)	CL	4
30–46	38	7–24	15	A–6(10)	A–6(16)	ML–CL	6
38–53	45	15–23	19	A–7–6(11)	A–7–6(13)	ML–CL	4
32–45	39	13–22	17	A–6(10)	A–6(11)	CL	5
31–53	42	13–32	22	A–7–6(13)	A–7–6(15)	CL	5
23–43	33	5–16	10	A–6(4)	A–6(3)	ML–CL	7
18–46	32	2–24	13	A–6(3)	A–6(2)	SC	8
14–33	23	0–17	6	A–2–4(0)	A–2–4(0)	SM–SC	---
13–47	30	0–27	11	A–2–6(0)	A–2–6(0)	SC	---
22–55	39	4–32	17	A–6(10)	A–6(11)	CL	5
8–36	22	0–19	6	A–2–4(0)	A–2–4(0)	SM–SC	---
41–51	46	14–25	19	A–7–6(13)	A–7–6(20)	ML–CL	4
38–52	45	15–30	22	A–7–6(14)	A–7–6(22)	CL	4
30–56	43	10–35	22	A–7–6(14)	A–7–6(19)	CL	4
24–51	38	8–30	19	A–6(10)	A–6(11)	CL	6
38–47	43	11–22	16	A–7–6(11)	A–7–6(14)	ML–CL	4
25–47	36	7–24	15	A–6(10)	A–6(10)	CL	6
2–39	21	0–20	7	A–2–4(0)	A–2–4(0)	SM–SC	---
34–55	45	8–31	19	A–7–6(13)	A–7–6(17)	ML–CL	4
31–55	43	10–33	21	A–7–6(13)	A–7–6(18)	CL	4
31–59	45	10–36	22	A–7–6(14)	A–7–6(18)	CL	4
0–38	13	0–18	5	A–2–4(0)	A–2–4(0)	SM–SC	---
33–71	52	12–44	28	A–7–6(18)	A–7–6(23)	CH	3
38–71	55	15–49	32	A–7–6(19)	A–7–6(32)	CH	3
19–65	42	4–41	22	A–7–6(14)	A–7–6(18)	CL	5
0–30	11	0–11	3	A–2–4(0)	A–2–4(0)	SM	---
40–51	45	12–22	16	A–7–6(12)	A–7–6(19)	ML–CL	4
32–49	41	10–26	18	A–7–6(11)	A–7–6(19)	CL	5
32–45	38	10–25	17	A–6(11)	A–6(17)	CL	6
20–49	34	5–28	16	A–6(9)	A–6(9)	CL	7
35–47	41	10–17	13	A–7–6(9)	A–7–6(15)	ML–CL	5
28–46	37	6–23	14	A–6(10)	A–6(14)	CL	6
30–46	38	9–28	18	A–6(11)	A–6(16)	CL	6
---	27	---	8	A–4(7)	A–4(4)	CL	10
34–45	40	5–22	13	A–6(6)	A–6(6)	ML–CL	5
3–47	25	0–19	7	A–2–4(0)	A–2–4(0)	SC	---
7–47	27	0–24	10	A–2–4(0)	A–2–4(0)	SC	---

TABLE 7.—*Engineering test data for soil samples*

Soil series	Horizon	Number of samples tested	Mechanical analysis [1]							
			Percentage less than 3 inches passing sieve—						Percentage smaller than 0.005 mm	
			No 10 (2.0 mm)		No 40 (0.42 mm)		No 200 (0.074 mm)			
			Range	Average	Range	Average	Range	Average	Range	Average
Tetonka.	A	46	94–100	99	85–100	94	58–100	79	15–47	31
	B	135	95–100	98	86–100	94	60–96	78	23–53	39
	C	94	91–100	97	80–100	91	53–93	73	23–52	37
Thurman.	A	6	97–100	99	82–95	89	15–40	28	6–16	10
	C	14	84–100	95	58–100	83	1–52	27	4–18	11
Viborg.	A	15	----------	100	96–100	98	83–98	91	19–47	32
	B	45	98–100	99	93–100	97	82–100	92	25–55	39
	C	9	99–100	100	94–100	98	76–100	92	23–55	38
	IIC	15	89–100	96	77–100	89	54–87	71	25–46	35
Wentworth.	A	51	94–100	99	88–100	96	69–100	86	7–43	25
	B	171	94–100	99	87–100	95	65–100	86	11–45	28
	C	103	94–100	98	85–100	94	59–100	81	15–46	30
	IIC	28	68–100	90	48–100	78	27–87	57	2–43	22
Worthing.	A	4	97–100	99	91–100	97	68–100	87	28–44	36
	B	14	98–100	100	94–100	97	77–100	89	27–48	37
	C	11	95–100	98	88–100	95	67–98	83	24–59	41

[1] Mechanical analyses according to AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all material including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analysis data used in this table are not intended for naming textural classes for soils.

use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and windbreaks; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*7*).

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that soils of similar genesis, or mode of origin, are grouped. The same property or subdivisions of this property may be used in several different categories. In table 8, the soil series of Lincoln County are placed in some categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

Order.—Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. Three exceptions to this are the Entisols, Histosols, and Vertisols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol.* An example is *Mollisol.*

Suborder.—Each order is divided into suborders, using those soil characteristics that seem to produce classes that have the greatest genetic similarity. The suborders are more narrowly defined than the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of a water table at a shallow depth; soil climate; the accumulation of clay, iron, or organic carbon in the upper part of the solum; cracking of soils caused by a decrease in soil moisture; and fine stratification. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquoll* (*Aqu,* meaning water or wet, and *oll,* from Mollisol).

Great group.—A suborder is divided into great groups on the basis of uniformity in the kinds and sequence of soil horizons and features. The horizons used to make separations are those in which clay, carbonates, and other constituents have accumulated or have been removed and those that have pans that interfere with growth of roots, movement of water, or both. Some

taken along proposed highway routes—Continued

Liquid limit [2]		Plasticity [3] index		Classification			Estimated California bearing ratio [4]
Range	Average	Range	Average	AASHO [5] (Old index)	AASHO [6] (New index)	Unified [7]	
31–53	42	8–27	17	A–7–6 (12)	A–7–6 (14)	ML–CL	5
35–61	48	15–38	26	A–7–6 (16)	A–7–6 (21)	CL	4
32–62	47	16–38	26	A–7–6 (16)	A–7–6 (19)	CL	4
18–27	23	0–10	4	A–2–4 (0)	A–2–4 (0)	SM–SC	----------
17–27	22	0–11	5	A–2–4 (0)	A–2–4 (0)	SM–SC	----------
40–56	48	14–27	20	A–7–6 (14)	A–7–6 (21)	ML–CL	4
43–58	50	16–35	25	A–7–6 (16)	A–7–6 (27)	CL	3
36–60	48	15–37	26	A–7–6 (16)	A–7–6 (26)	CL	4
33–49	41	17–28	22	A–7–6 (13)	A–7–6 (14)	CL	5
36–52	44	10–25	17	A–7–6 (12)	A–7–6 (17)	ML–CL	4
34–50	42	12–27	19	A–7–6 (12)	A–7–6 (17)	CL	5
30–50	40	10–29	19	A–6 (12)	A–6 (16)	CL	5
20–46	33	6–27	16	A–6 (7)	A–6 (6)	CL	7
42–55	49	19–26	22	A–7–6 (15)	A–7–6 (22)	ML–CL	3
34–72	53	11–46	28	A–7–6 (18)	A–7–6 (28)	CH	3
31–63	47	14–40	26	A–7–6 (16)	A–7–6 (22)	CL	4

[2] Based on AASHO Designation T 89–60 (*1*).
[3] Based on AASHO Designation T 90–61 (*1*).
[4] Estimated values based on relationships between California Bearing Ratio and liquid limit.
[5] Based on AASHO Designation M 145–49 (*1*).
[6] Based on AASHO Designation M 145–66 (*1*).
[7] Based on the Unified soil classification system (*9*).

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Alcester	Fine-silty, mixed, mesic	Cumulic Haplustolls	Mollisols.
Bon	Fine-loamy, mixed, mesic	Cumulic Haplustolls	Mollisols.
Chancellor	Fine, montmorillonitic, mesic	Typic Argiaquolls	Mollisols.
Clamo	Fine, montmorillonitic, mesic	Cumulic Haplaquolls	Mollisols.
Crofton	Fine-silty, mixed (calcareous), mesic	Typic Ustorthents	Entisols.
Davis	Fine-loamy, mixed, mesic	Pachic Haplustolls	Mollisols.
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Udic Haplustolls	Mollisols.
Dempster	Fine-silty over sandy or sandy-skeletal, mixed, mesic	Udic Haplustolls	Mollisols.
Egan	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
Graceville	Fine-silty, mixed, mesic	Pachic Haplustolls	Mollisols.
Huntimer	Fine, montmorillonitic, mesic	Udic Haplustolls	Mollisols.
Lamo	Fine-silty, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols.
Luton	Fine, montmorillonitic, mesic	Vertic Haplaquolls	Mollisols.
Moody	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
Nora	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
Renner	Fine-loamy, mixed, mesic	Pachic Argiustolls	Mollisols.
Salmo	Fine-silty, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols.
Shindler	Fine-loamy, mixed, mesic	Udorthentic Haplustolls	Mollisols.
Steinauer	Fine-loamy, mixed (calcareous), mesic	Typic Udorthents	Entisols.
Talmo	Sandy-skeletal, mixed, mesic	Udorthentic Haplustolls	Mollisols.
Tetonka	Fine, montmorillonitic, mesic	Argiaquic Argialbolls	Mollisols.
Thurman	Sandy, mixed, mesic	Udorthentic Haplustolls	Mollisols.
Viborg	Fine-silty, mixed, mesic	Pachic Haplustolls	Mollisols.
Wakonda	Fine-silty, mixed, mesic	Aeric Calciaquolls	Mollisols.
Wentworth	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
Worthing	Fine, montmorillonitic, mesic	Typic Argiaquolls	Mollisols.

features used are soil acidity, soil climate, soil composition, and soil color. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Haplaquoll* (*Hapl,* meaning simple horizons, and *aquoll,* as defined under suborder).

Subgroup.—A great group is divided into subgroups, one that represents the central (typic) segment of the group and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives in front of the name of the great group. An example is *Typic Haplaquoll* (a typical Haplaquoll).

Family.—Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, soil depth, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and other criteria that are used as family differentiae.

Additional Information About the County

Lincoln County, which was named for President Abraham Lincoln, was created by an act of the Dakota Territorial Legislature April 5, 1862. The boundaries of the county at that time included all of the present-day county and what are now the two northern tiers of townships of Union County and the two eastern tiers of Turner County. In 1871 the Legislature assigned the present boundaries to the county.

The earliest-known settlement in the county was on the site of the city of Canton in 1860. Large-scale settlement, however, was not underway until after 1866. Settlement and development of the county progressed slowly until the coming of the railroad in 1879. During the period when homesteaders could file claims in Lincoln County, 2,211 persons acquired land.

The population of the county increased from 712 in 1870 to 13,918 in 1930. A gradual decline followed, to 11,761 in 1970. Most of the population is rural. Canton, the county seat and largest town that is wholly within Lincoln County, had a population of 2,665 in 1970. A small part of the residential area of the city of Sioux Falls extends into the northern edge of this county. Sioux Falls had a population of 72,665 in 1970.

High schools, as well as grade schools, are provided in four towns in Lincoln County. A few rural grade schools also are provided. Churches of many faiths are in all towns, and there are numerous country churches as well.

Lincoln County has a variety of outdoor recreation, including fishing, hunting, and water sports. The Big Sioux River, which makes up the eastern border of the county, provides excellent cover for wild game. Lake Lakota and Lake Alvin provide good fishing and water sports. Excellent picnic and campground facilities are provided in the Newton Hills State Park. This State park is almost entirely wooded, and it is one of the most frequently visited State parks in eastern South Dakota.

Ground water in adequate quantities to supply farm wells is available in most parts of the county. The largest areas of readily accessible, shallow ground water are along the Big Sioux River and some of its tributaries and along Long Creek. There probably is enough shallow ground water to supply irrigation wells in most areas along these streams. The quality of the water in the county varies greatly over short distances, but as a whole the water is generally satisfactory for irrigation. Sand and gravel suitable for subgrade material in roadbuilding are mainly along the Big Sioux River and along Long Creek. Smaller quantities of gravel also occur in scattered areas along the other creeks in the county.

In 1963 Lincoln County had eight manufacturing establishments. Of these eight establishments, seven employed less than 20 persons each.

Climate [8]

The climate of Lincoln County is continental. Winter is usually cold, and summer is warm to hot. Precipitation is marginal to adequate for adapted crops. No large bodies of water are nearby to affect the climate of the county, although the Big Sioux River meanders in a general north-to-south direction along the eastern border of the county and may affect the climate in its immediate vicinity.

This climatic summary is based on 55 years of weather records at Canton, located in the east-central part of the county at an elevation of 1,247 feet. The climate at Canton is representative of that over the county. The average annual temperature throughout the county is within 1° F of that at Canton. The average annual precipitation over the county is within 1 inch of that at Canton.

The seasonal range in temperature in Lincoln County is large, and occasionally there is a large change in temperature from one day to the next. The temperature usually rises to above 100° in summer and drops to 20° below zero or lower in winter. A reading of 100° or higher may be expected on an average of about two times a year in July, three times in 2 years in August, and two times in 3 years in June. A reading of 20° below zero may occur on an average of 3 to 4 days per year. A temperature of 30° below zero may be expected on an average of about once in 2 years. The temperature may drop to zero or less on an average of about 29 days per year and fail to climb above zero about 2 days per year. Temperatures may drop as much as 40 degrees from one day to the next with the passage of a strong cold front.

The probability of temperatures near freezing or below is shown in table 9. Table 10 shows other temperature data and precipitation data.

The annual precipitation at Canton averages 24.62 inches, of which 18.62 inches, or 76 percent, falls during the growing season (April to September). The annual

[8] By WALTER SPUHLER, climatologist for South Dakota, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Probabilities of stated temperatures after specified dates in spring and before specified dates in fall*

[Table prepared by WILLIAM F. LYTLE, South Dakota State University. Data recorded at Canton; period of record, 1916–70]

Probability	Dates for given probability and temperature					
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower	36° F or lower
After specified dates in spring:						
90 percent	March 7	March 18	March 28	April 5	April 19	May 4
70 percent	March 15	March 25	April 5	April 14	April 27	May 11
50 percent	March 28	April 8	April 19	April 29	May 11	May 21
30 percent	April 11	April 21	May 2	May 14	May 24	June 1
10 percent	April 19	April 29	May 10	May 23	June 1	June 7
Before specified dates in fall:						
10 percent	October 17	October 8	September 23	September 15	September 6	August 21
30 percent	October 24	October 15	October 2	September 23	September 14	August 31
50 percent	November 6	October 28	October 16	October 6	September 27	September 17
70 percent	November 19	November 9	October 30	October 18	October 10	October 4
90 percent	November 26	November 16	November 7	October 26	October 18	October 14

TABLE 10.—*Temperature and precipitation*

[Data recorded at Canton; period of record, 1916–70]

Month	Temperature				Precipitation							
	Average daily high	Average daily low	Two years in 10 will have— Average daily high equal to or higher than—	Two years in 10 will have— Average daily low equal to or lower than—	Average total	Maximum total	Minimum total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Average total snowfall	Average number of days that have— Snowfall of 1 inch or more	Average number of days that have— Snow cover of 1 inch or more
	°F	°F	°F	°F	In	In	In	In	In	In		
January	27.4	5.5	36.1	1.2	0.61	2.26	0.00	0.10	1.22	6.3	3	13
February	32.6	10.4	40.8	3.5	.86	3.68	.00	.09	1.87	7.7	3	11
March	44.4	22.1	52.8	15.7	1.40	4.35	.00	.37	2.71	8.8	3	7
April	61.1	35.2	67.4	30.4	2.33	5.31	.02	.62	4.49	1.0	(1)	1
May	73.4	46.5	79.5	41.2	3.23	8.52	.32	1.14	5.80	0.0	(1)	0
June	82.2	56.6	87.6	52.1	4.31	10.96	1.31	2.11	6.86	0.0	0	0
July	88.6	61.8	93.0	57.8	2.80	6.99	.32	.91	5.16	0.0	0	0
August	86.5	59.4	91.2	55.5	3.21	10.27	.25	.79	6.33	0.0	0	0
September	76.9	49.9	82.2	45.5	2.74	7.59	.07	.79	5.23	0.0	0	0
October	65.1	38.0	71.8	32.7	1.40	5.45	.00	.19	2.97	0.6	(1)	(1)
November	45.9	24.0	51.7	18.7	1.00	4.45	.00	.09	2.20	3.0	1	3
December	32.0	11.8	38.9	4.9	.73	3.25	.00	.08	1.60	6.4	2	10
Year	59.7	35.1	79.2	33.0	24.62	[2] 37.09	[3] 13.38	19.82	30.31	33.8	12	45

[1] Less than one-half day.
[2] 1951.
[3] 1958.

precipitation has varied from 13.38 inches in 1958 to 37.09 inches in 1951. Thundershowers are the main source of precipitation during the growing season, and they vary widely in intensity and in amount of precipitation. Rainfall of 1 inch or more per hour may be expected on an average of about once a year. A 2-inch or more rainfall in 1 hour may occur an average of about once in 5 years. A 24-hour rainfall of 2 inches or more may occur on an average of about once a year and of 3 inches or more, about once in 4 years.

Hail occasionally accompanies the thundershowers. It may be expected on an average of about two to three times per year in any one place in the county. May, June, and July are the months of most frequent occurrence, but hail may occur as early as March and as late as October.

Snowfall is an important contributor to the annual precipitation, although it is relatively small compared to rainfall. Snow cover is important for protecting pasture and fall-seeded crops, but a heavy snow cover may hinder farm activity. The seasonal snowfall averages 34 inches but ranges from 2 inches during the season. Strong winds often accompany the snowfall, causing large drifts in and near sheltered areas, while open fields remain nearly bare. Snow cover of 1 inch or more during the past 30 years averaged about 68 days per year, and a cover of 4 inches or more averaged about 23 days per year. Snow cover for earlier years is not well documented.

Data on wind, relative humidity, and sunshine are not recorded at Canton. However, data from Sioux Falls can be used to estimate conditions in Lincoln County.

Windspeed averages about 11 miles per hour, and the prevailing wind generally is from the south in summer and from the northwest in winter. Strong wind of 50 miles per hour or more can occur any month of the year but is most likely during thunderstorms in summer. Other times of the year strong wind may be associated with the passage of a strong cold front or a deep low-pressure area. It is possible for a tornado to touch down in Lincoln County, but it is difficult to give a meaningful probability of this rare event.

Relative humidity has an appreciable variation from early morning to afternoon. It ranges from about 50 percent in the afternoon to 82 percent in early morning during summer, and from about 65 percent in the afternoon to 80 percent in early morning during winter.

Sunshine is an important factor in crop production and recreational activity. This area receives about 65 percent of the total possible sunshine. It receives the highest percentage of possible sunshine, about 75 percent, in July and August.

Water loss experienced by soils and crops is indicated by evaporation from a large pan. The average annual National Weather Service Class A pan evaporation is about 50 inches, of which about 39 inches, or 77 percent of the annual evaporation, is from May to October. The pan evaporation represents a maximum, or potential, evaporation. The average annual evaporation from small lakes is about 36 inches. The actual loss from soil is usually less, depending on the available soil moisture.

Transportation and Markets

The main thoroughfares serving the county are U.S. Highways Nos. 18 and 77, Interstate Highways Nos. 29 and 229, and State Highways Nos. 17, 44, 46, and 11. Rural roads run along most section lines. Many of these roads are gravelled, but some are hard surfaced. Rural mail routes reach all parts of the county.

Railroad service is provided by several railways, and air transportation is provided by several scheduled airlines that serve the city of Sioux Falls.

Markets for all farm products are readily available. Livestock auctions are held each week in Canton. Cattle and hogs that are not sold at local auctions are sold through public stockyards or to packers in Sioux Falls, South Dakota, or Sioux City, Iowa. Some cattle are sold to small packing plants in other surrounding towns.

Grain and feed products that are not used or stored on the farms are sold to local elevators in Beresford, Canton, Fairview, Hudson, Lennox, Tea, and Worthing. Most poultry and dairy products are marketed in Canton, Sioux Falls, or other nearby towns.

Farming

In 1969 land in farms in Lincoln County totaled 352,820 acres, which is about 96 percent of the county. The 1,324 farms had an average size of 266.4 acres. The average size of farms has gradually increased since 1935.

Corn, oats, soybeans, and alfalfa are the main crops grown. In 1969 corn for grain was harvested from 113,711 acres, oats from 45,199 acres, soybeans from 27,184 acres, and alfalfa hay from 16,078 acres. Small acreages were reported for wheat, barley, flax, rye, tame grasses, and wild hay. About 23 percent of the total farm income in Lincoln County is from the sale of cash crops.

Livestock on farms reported in the 1969 census included 59,831 cattle and calves, 64,066 hogs and pigs, 15,057 sheep and lambs, and 117,859 chickens. About 77 percent of the total cash-farm income in the county during 1969 came from the sale of livestock and livestock products.

Information about the history of crop and livestock production in the county can be obtained from the annual reports of the South Dakota Crop and Livestock Reporting Service (*5*).

Literature Cited

(1) American Association of State Highway Officials. 1961. Standard specifications for highway materials and methods of sampling and testing. Ed. 8, 2 vol., illus.

(2) Ferber, Arthur E. 1969. Windbreaks for conservation. U.S. Dep. Agric. Inf. Bull. 339, 30 pp., illus.

(3) Flint, R. F. 1955. Pleistocene geology of eastern South Dakota. U.S. Geol. Surv., Prof. Pap. 262, 173 pp., illus.

(4) Rothrock, E. P. 1943. A geology of South Dakota. part 1, the surface. S. Dak. Geol. Surv. Bull. 13, 88 pp., illus.

(5) South Dakota Crop and Livestock Reporting Service. 1970. South Dakota agriculture. 66 pp., illus [Issued annually]

(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus [Supplement issued in May 1962]

(7) ———. 1960. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. [Supplements issued in March 1967 and September 1968]

(8) ———. 1961. Land-capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(9) United States Department of Defense. 1968. Unified soil classification system for roads, airfields, embankments and foundations. MIL–STD–619B, 30 pp., illus.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bottom land. Lowland formed by alluvial deposit along a stream or in a lake basin; a flood plain.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Crop residue use. The system of retaining crop residue on land between harvest and replanting to prevent erosion, insuring future crop production.

Dike. A ridge of earth that is thrown up to impound water, as in irrigation, or to divert water, as in soil erosion control.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Emergency tillage. Cultivation by listing, ridging, duckfooting, chiseling, pitting basin listing, or other means to roughen the soil surface for temporary control of wind erosion.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Glacial drift (geology). Rock material transported by glacial ice and then deposited; also includes the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders, transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Gravel. Rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Loam. Soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Minimum tillage. The least amount of tillage required for quick germination and a good stand. Several implements may be drawn behind the tractor to reduce the number of times it is driven over the field, but the term does not imply that primary tillage, secondary tillage, fertilization, and seeding must be done in one trip across the field.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff (hydraulics). The part of the precipitation on a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants, but that does not contain excess exchangeable sodium. Ratings for the salinity classes of soils, based on the electrical conductivity of the saturation extract, as expressed in millimhos per centimeter at 25° C are as follows:

Salinity classes	*Numerical ratings Mmho/cm*
None	Less than 2.0
Low	2.0 to 4.0
Moderate	4.0 to 8.0
High	8.0 to 16.0
Very high	More than 16.0

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. A term used in nontechnical profile descriptions for a layer below the surface layer but not part of the subsoil; generally, the A2 horizon.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Generally the A, A1, or Ap horizon.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Underlying material. The part of the soil beneath the solum.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

Absence of a capability unit, pasture group, or windbreak group designation indicates that the mapping unit is not placed in a specified grouping; or that the individual soils of a mapping unit are designated separately For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. All pasture groups are described on pages 44 and 45, and all windbreak groups are described on pages 48 and 49. Other information is given in tables as follows:

Acreage and extent, table 1, page 9.
Predicted yields, table 2, page 46.

Engineering uses of the soils, tables 4, 5, 6, and 7, pages 54 to 75.

Map symbol	Mapping unit	Described on page	Capability unit		Pasture group	Windbreak group
			Symbol	Page	Letter	Number
AcA	Alcester silty clay loam, 0 to 2 percent slopes	10	I-1	36	K	1
AcB	Alcester silty clay loam, 2 to 6 percent slopes	10	IIe-1	37	K	1
Af	Alcester silty clay loam, channeled	10	VIw-1	42	K	10
Ah	Alcester and Lamo silty clay loams	10	------	--	---	--
	Alcester part	--	I-1	36	K	1
	Lamo part	--	------	--	---	2
	If drained	--	IIw-3	38	A	--
	If not drained	--	IVw-2	40	B	--
Bo	Bon soils, frequently flooded	11	IIIw-4	39	K	1
Ca	Chancellor-Tetonka silty clay loams	12	IIw-1	38	---	--
	Chancellor part	--	------	--	A	2
	Tetonka part	--	------	--	---	10
	If drained	--	------	--	A	--
	If not drained	--	------	--	B	--
Cd	Chancellor-Viborg silty clay loams	12	IIw-1	38	---	--
	Chancellor part	--	------	--	A	2
	Viborg part	--	------	--	K	1
Ch	Chancellor-Wakonda-Tetonka complex	13	IIw-1	38	---	--
	Chancellor part	--	------	--	A	2
	Wakonda part	--	------	--	F	1
	Tetonka part	--	------	--	---	10
	If drained	--	------	--	A	--
	If not drained	--	------	--	B	--
Co	Clamo silty clay loam	13	------	--	---	2
	If drained	--	IIw-3	38	A	--
	If not drained	--	IVw-2	40	B	--
CpD2	Crofton-Nora silt loams, 9 to 17 percent slopes, eroded	14	VIe-3	42	---	10
	Crofton part	--	------	--	G	--
	Nora part	--	------	--	F	--
Da	Davis loam	15	I-1	36	K	1
DeA	Delmont loam, 0 to 2 percent slopes	16	IIIs-3	40	D	10
DeB	Delmont loam, 2 to 6 percent slopes	16	IVs-2	41	D	10
DgB	Delmont-Graceville complex, 2 to 6 percent slopes	16	IVs-2	41	---	--
	Delmont part	--	------	--	D	10
	Graceville part	--	------	--	K	1
DkB	Delmont and Talmo soils, 2 to 9 percent slopes	16	------	--	---	10
	Delmont part	--	IVs-2	41	D	--
	Talmo part	--	VIs-3	42	---	--
DmA	Dempster silt loam, 0 to 2 percent slopes	17	IIs-3	38	D	6
DmB	Dempster silt loam, 2 to 6 percent slopes	17	IIIs-2	40	D	6
EaB	Egan silty clay loam, 3 to 6 percent slopes	18	IIe-3	38	F	3
EcB	Egan-Chancellor silty clay loams, 2 to 4 percent slopes	19	IIe-3	38	---	--
	Egan part	--	------	--	F	3
	Chancellor part	--	------	--	A	2

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Pasture group Letter	Windbreak group Number
EsB	Egan-Shindler complex, 2 to 6 percent slopes	19	IIe-3	38	---	3
	Egan part	--	------	--	F	--
	Shindler part	--	------	--	G	--
EsC	Egan-Shindler complex, 6 to 9 percent slopes	19	IIIe-2	39	---	3
	Egan part	--	------	--	F	--
	Shindler part	--	------	--	G	--
EwB	Egan-Worthing complex, 2 to 6 percent slopes	19	IIe-3	38	---	--
	Egan part	--	------	--	F	3
	Worthing part	--	------	--	---	10
	If drained	--	------	--	A	--
	If not drained	--	------	--	B	--
Gr	Graceville silty clay loam	20	I-3	37	K	1
HuA	Huntimer silty clay loam, 0 to 2 percent slopes	21	IIs-2	38	I	4
La	Lamo silty clay loam	21	------	--	---	2
	If drained	--	IIw-3	38	A	--
	If not drained	--	IVw-2	40	B	--
Lu	Luton silty clay	22	------	--	---	--
	If drained	--	IIIw-2	39	A	2
	If not drained	--	Vw-2	41	B	10
Mh	Marsh	22	VIIIw-1	43	---	--
MoA	Moody silty clay loam, 0 to 2 percent slopes	23	I-2	37	F	3
MoB	Moody silty clay loam, 2 to 6 percent slopes	24	IIe-3	38	F	3
MpB	Moody-Nora silty clay loams, 2 to 6 percent slopes	24	IIe-3	38	F	3
MpC2	Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded	24	IVe-1	40	F	3
Sa	Salmo silty clay loam, very wet	27	Vw-1	41	J	10
ShD	Shindler clay loam, 9 to 15 percent slopes	28	VIe-3	42	G	10
ShF	Shindler clay loam, 25 to 40 percent slopes	28	VIIe-1	43	---	10
SkD2	Shindler-Egan complex, 9 to 15 percent slopes, eroded	28	VIe-3	42	---	10
	Shindler part	--	------	--	G	--
	Egan part	--	------	--	F	--
SmF	Shindler-Renner complex, 15 to 40 percent slopes	28	VIIe-1	43	---	10
StD	Shindler and Talmo soils, 6 to 30 percent slopes	29	------	--	---	10
	Shindler part	--	VIe-3	42	G	--
	Talmo part	--	VIIs-2	43	---	--
SuF	Steinauer-Shindler clay loams, 24 to 40 percent slopes	29	VIIe-1	43	---	10
Te	Tetonka silty clay loam	31	------	--	---	10
	If drained	--	IIw-1	38	A	--
	If not drained	--	IVw-2	40	B	--
ThB	Thurman fine sandy loam, 2 to 6 percent slopes	32	IIIe-7	39	H	5
ThC	Thurman fine sandy loam, 6 to 9 percent slopes	32	IVe-3	40	H	5
WeA	Wentworth silty clay loam, 0 to 2 percent slopes	34	I-2	37	F	3
WhA	Wentworth-Chancellor silty clay loams, 0 to 2 percent slopes	34	I-2	37	---	--
	Wentworth part	--	------	--	F	3
	Chancellor part	--	------	--	A	2
Ws	Worthing silty clay	35	------	--	---	10
	If drained	--	IIIw-1	39	A	--
	If not drained	--	Vw-2	41	B	--

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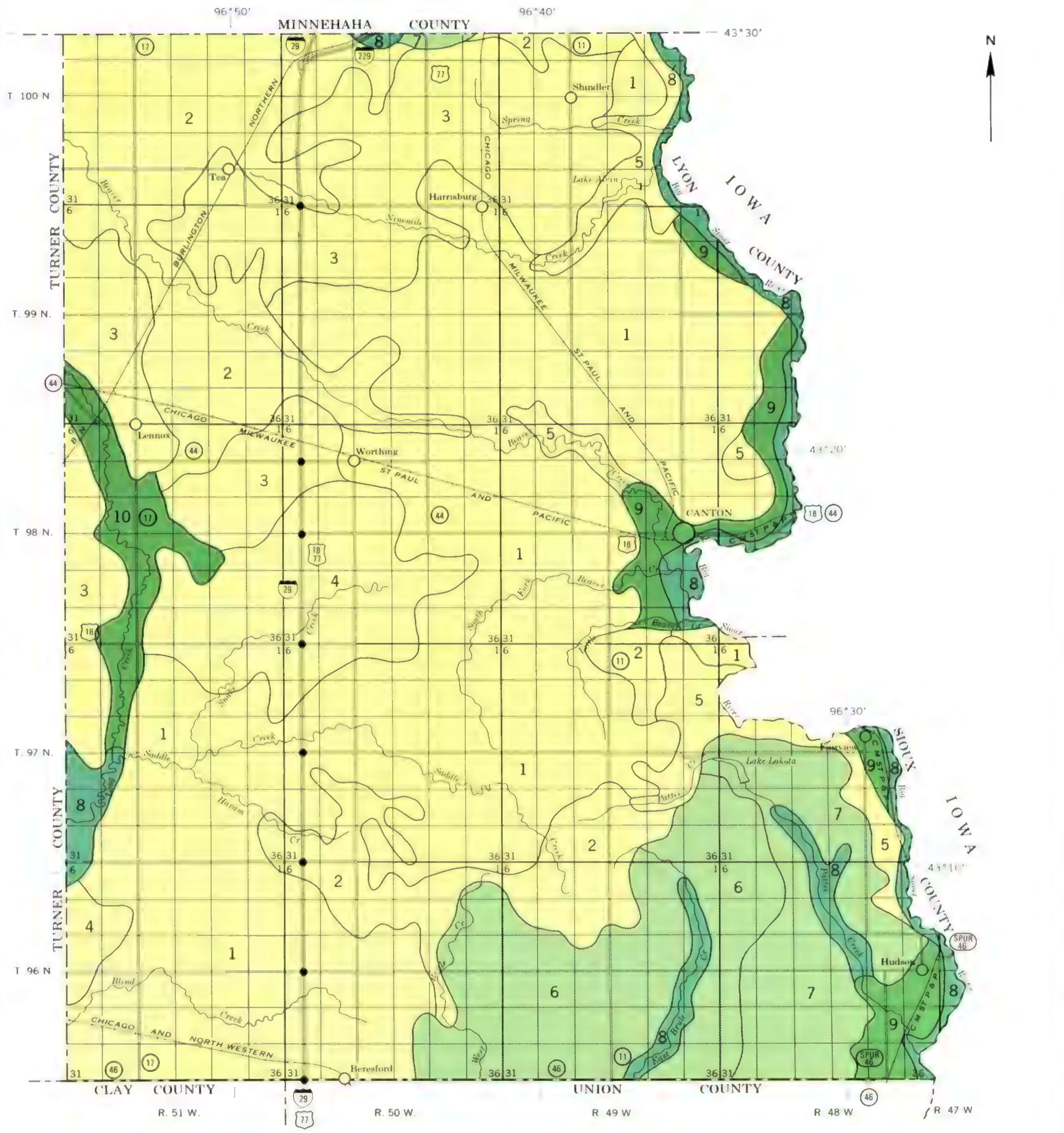


SOIL ASSOCIATIONS*

SOILS FORMED IN GLACIAL DRIFT AND GLACIAL TILL; ON UPLANDS

1 Wentworth-Chancellor association: Deep, well drained and somewhat poorly drained, nearly level, silty soils

2 Egan-Shindler-Worthing association: Deep, well-drained, gently sloping to rolling, silty and loamy soils; and poorly drained, level, clayey soils

3 Egan-Chancellor association: Deep, well drained and somewhat poorly drained, mainly gently undulating or gently sloping, silty soils

4 Chancellor-Wakonda-Tetonka association: Deep, moderately well drained to poorly drained, nearly level and level, silty soils

5 Shindler-Steinauer-Renner association: Deep, well-drained, hilly to steep, loamy soils

SOILS FORMED IN LOESS; ON UPLANDS

6 Moody-Nora-Alcester association: Deep, well drained and moderately well drained, nearly level to sloping, silty soils

7 Nora-Moody-Crofton association: Deep, well-drained, gently sloping to strongly sloping, silty soils

SOILS FORMED IN ALLUVIUM; ON BOTTOM LANDS

8 Lamo-Bon-Clamo association: Deep, moderately well drained to poorly drained, level and nearly level, silty and loamy soils

SOILS UNDERLAIN BY SAND AND GRAVEL; ON HIGH TERRACES

9 Graceville-Dempster association: Moderately well drained and well drained, nearly level to gently sloping, silty soils that are deep and moderately deep over sand and gravel

10 Delmont-Graceville-Talmo association: Moderately well drained to excessively drained, nearly level to undulating, loamy and silty soils that are deep to very shallow over sand and gravel

* Terms for texture refer to the surface layer of the major soils in each association unless otherwise indicated.

Compiled 1974

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

LINCOLN COUNTY, SOUTH DAKOTA

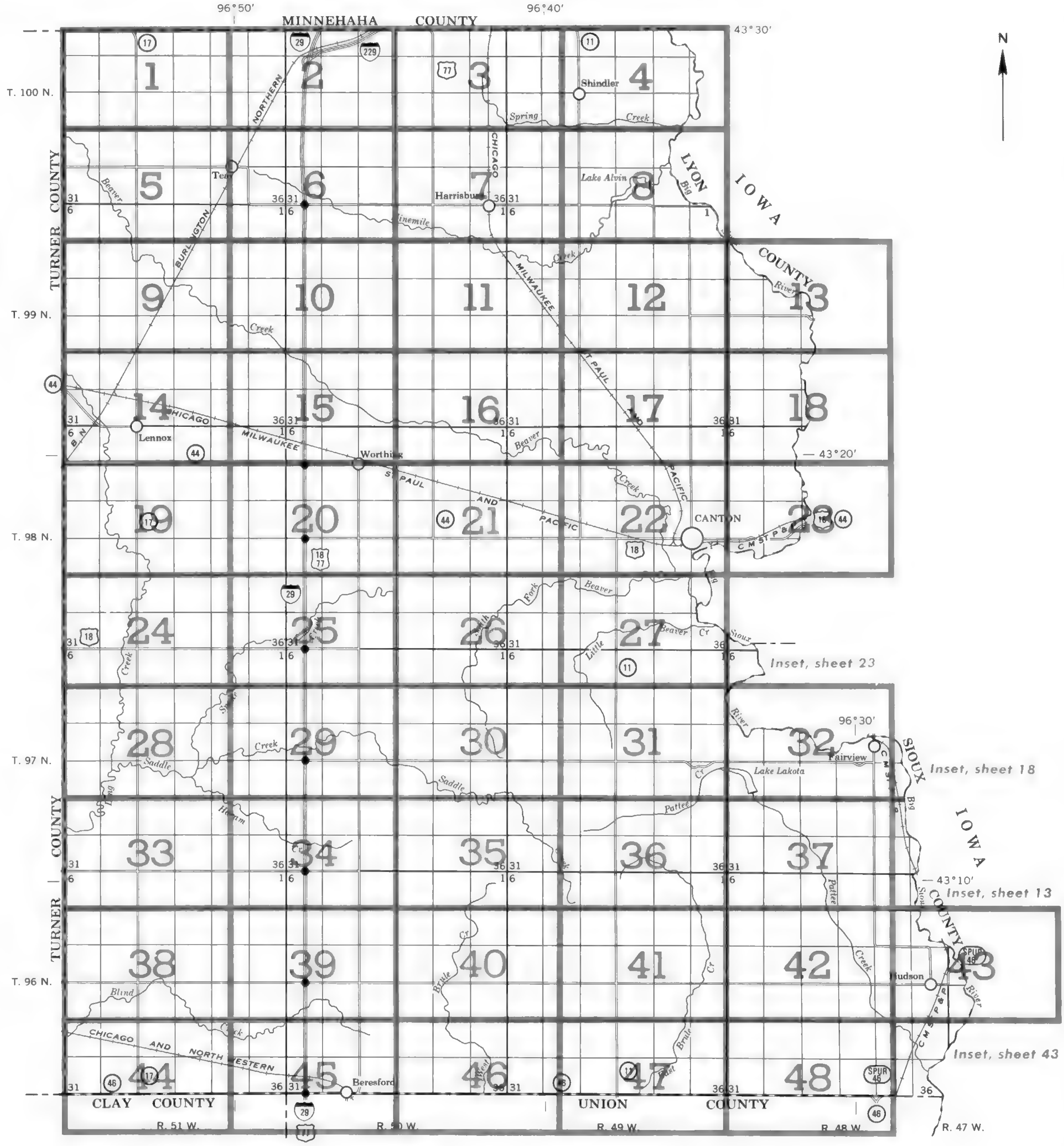
Scale 1:190,080

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

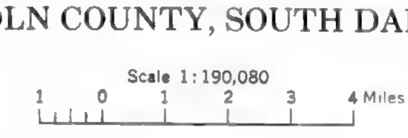
SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



INDEX TO MAP SHEETS

LINCOLN COUNTY, SOUTH DAKOTA



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Each soil symbol consists of two or three letters; for example AcA, Af, or Bo. If slope is given in the soil name, the third letter A, B, C, D, E, or F indicates the class of slope. Symbols without a slope letter are those of nearly level soils. A final number 2 in the symbol indicates that the soil is eroded.

SYMBOL	NAME
AcA	Alcester silty clay loam, 0 to 2 percent slopes
AcB	Alcester silty clay loam, 2 to 6 percent slopes
Af	Alcester silty clay loam, channeled
Ah	Alcester and Lamo silty clay loams
Bo	Bon soils, frequently flooded
Ca	Chancellor-Tetonka silty clay loams
Cd	Chancellor-Viborg silty clay loams
Ch	Chancellor-Wakonda-Tetonka complex
Co	Clamo silty clay loam
CpD2	Crofton-Nora silt loams, 9 to 17 percent slopes, eroded
Da	Davis loam
DeA	Delmont loam, 0 to 2 percent slopes
DeB	Delmont loam, 2 to 6 percent slopes
DgB	Delmont-Graceville complex, 2 to 6 percent slopes
DkB	Delmont and Talmo soils, 2 to 9 percent slopes
DmA	Dempster silt loam, 0 to 2 percent slopes
DmB	Dempster silt loam, 2 to 6 percent slopes
EaB	Egan silty clay loam, 3 to 6 percent slopes
EcB	Egan-Chancellor silty clay loams, 2 to 4 percent slopes
EsB	Egan-Shindler complex, 2 to 6 percent slopes
EsC	Egan-Shindler complex, 6 to 9 percent slopes
EwB	Egan-Worthing complex, 2 to 6 percent slopes
Gr	Graceville silty clay loam
HuA	Huntimer silty clay loam, 0 to 2 percent slopes
La	Lamo silty clay loam
Lu	Luton silty clay
Mh	Marsh
MoA	Moody silty clay loam, 0 to 2 percent slopes
MoB	Moody silty clay loam, 2 to 6 percent slopes
MpB	Moody-Nora silty clay loams, 2 to 6 percent slopes
MpC2	Moody-Nora silty clay loams, 6 to 10 percent slopes, eroded
Sa	Salmo silty clay loam, very wet
ShD	Shindler clay loam, 9 to 15 percent slopes
ShF	Shindler clay loam, 25 to 40 percent slopes
SkD2	Shindler-Egan complex, 9 to 15 percent slopes, eroded
SmF	Shindler-Renner complex, 15 to 40 percent slopes
StD	Shindler and Talmo soils, 6 to 30 percent slopes
SuF	Steinauer-Shindler clay loams, 24 to 40 percent slopes
Te	Tetonka silty clay loam
ThB	Thurman fine sandy loam, 2 to 6 percent slopes
ThC	Thurman fine sandy loam, 6 to 9 percent slopes
WeA	Wentworth silty clay loam, 0 to 2 percent slopes
WhA	Wentworth-Chancellor silty clay loams, 0 to 2 percent slopes
Ws	Worthing silty clay

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit (GP)

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Watershed structure

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

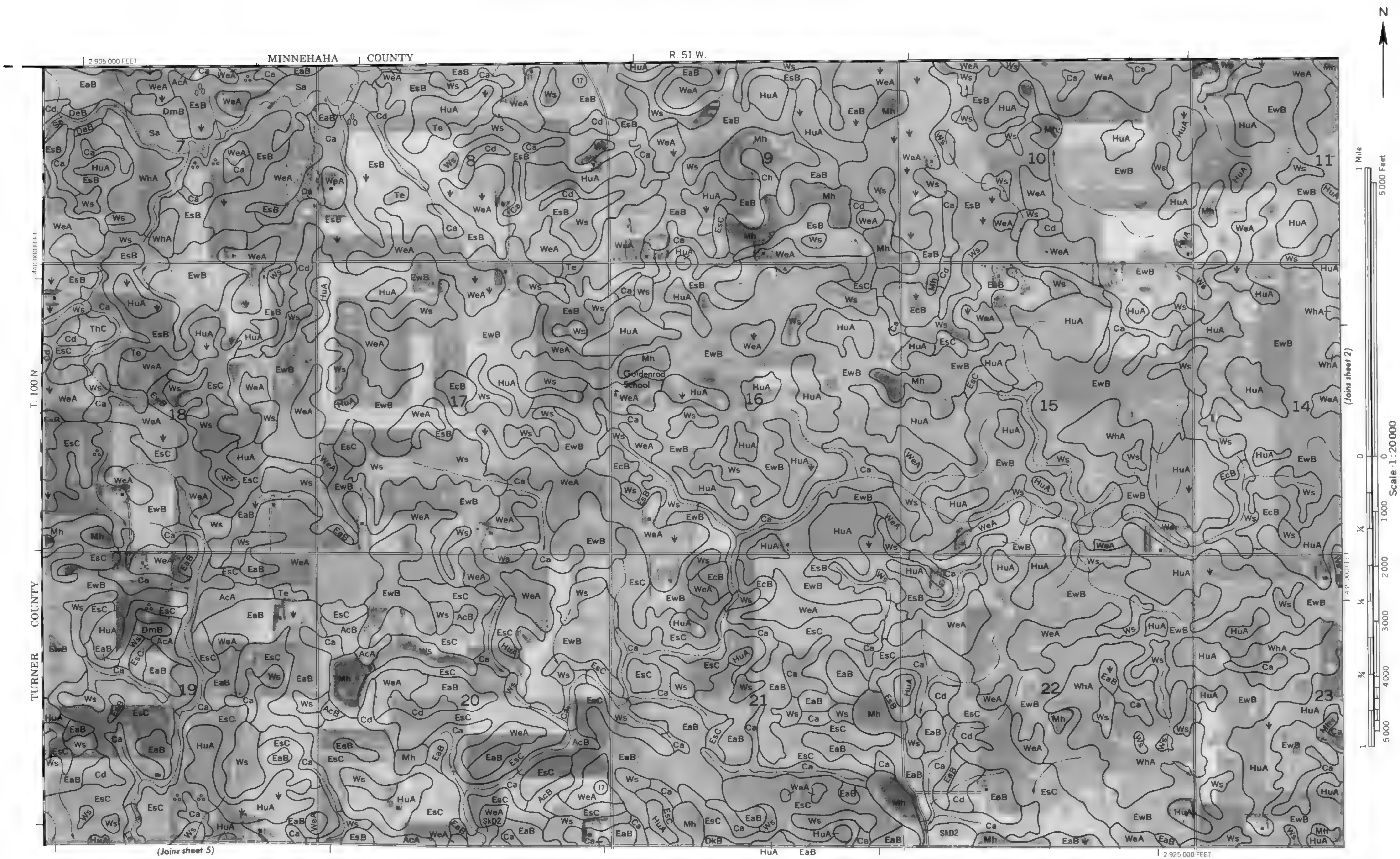
Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Borrow pit (BP)

1



LINCOLN COUNTY, SOUTH DAKOTA NO. 1

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 10

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LINCOLN COUNTY, SOUTH DAKOTA NO. 11

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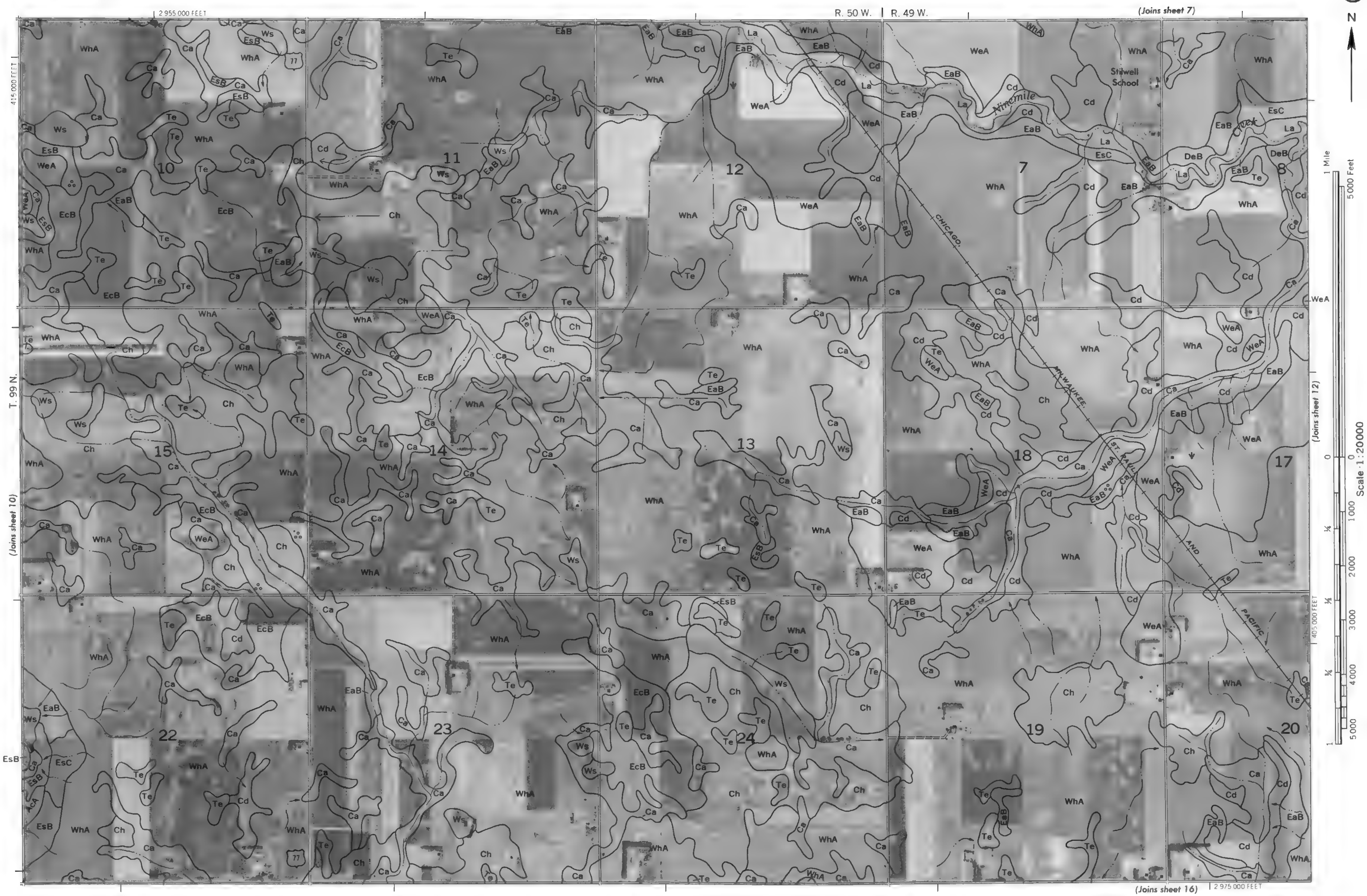

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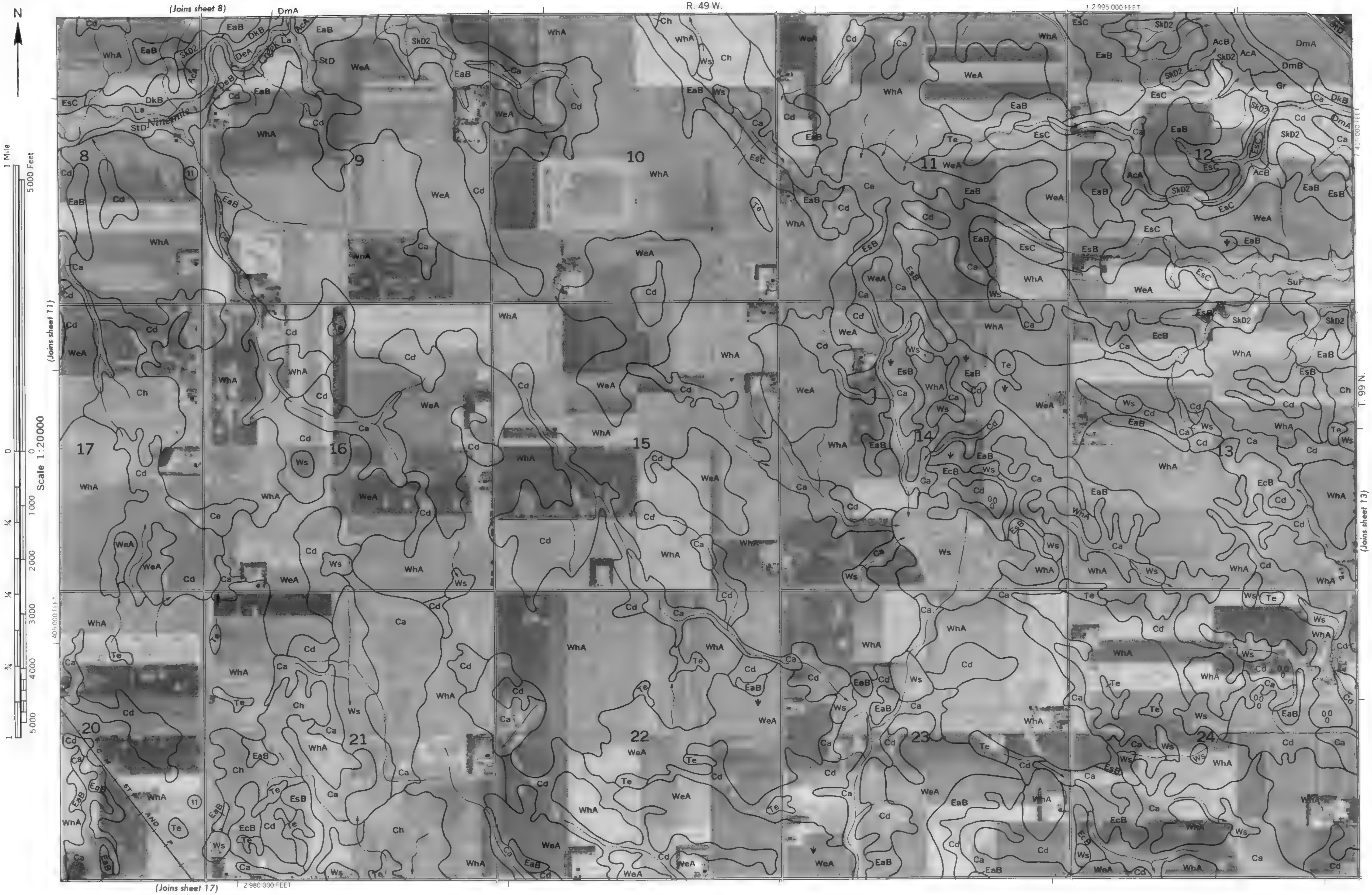

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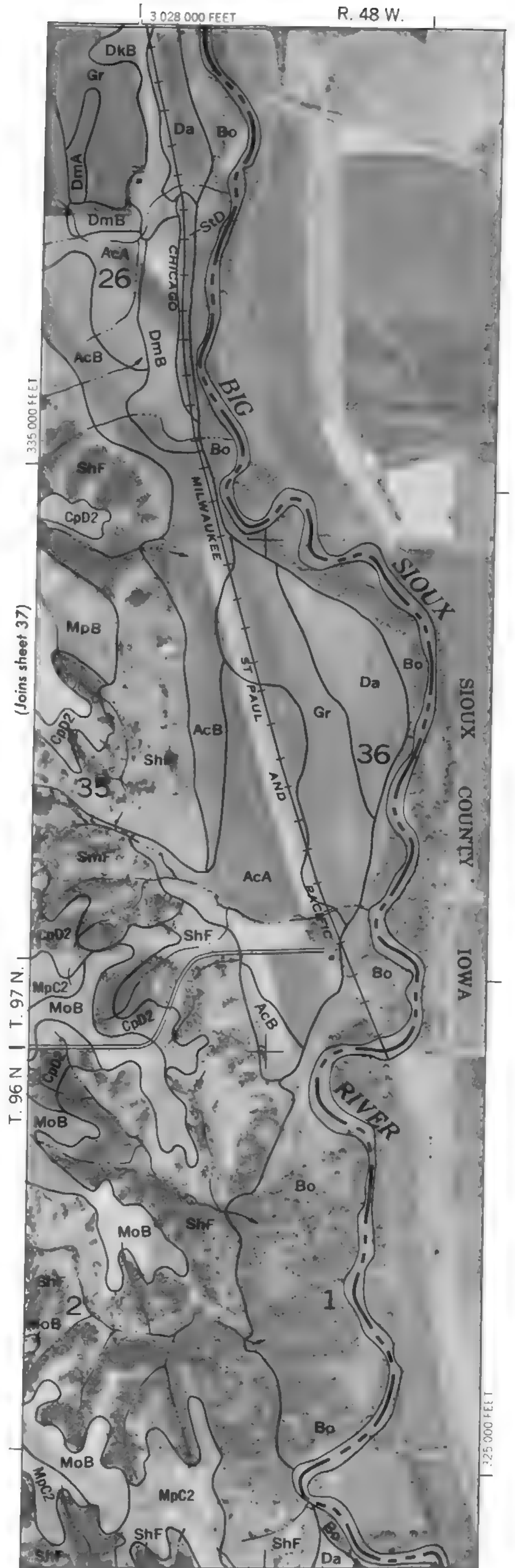

3000 AND 5000 FOOT GRID TICKS

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

LINCOLN COUNTY, SOUTH DAKOTA NO. 13

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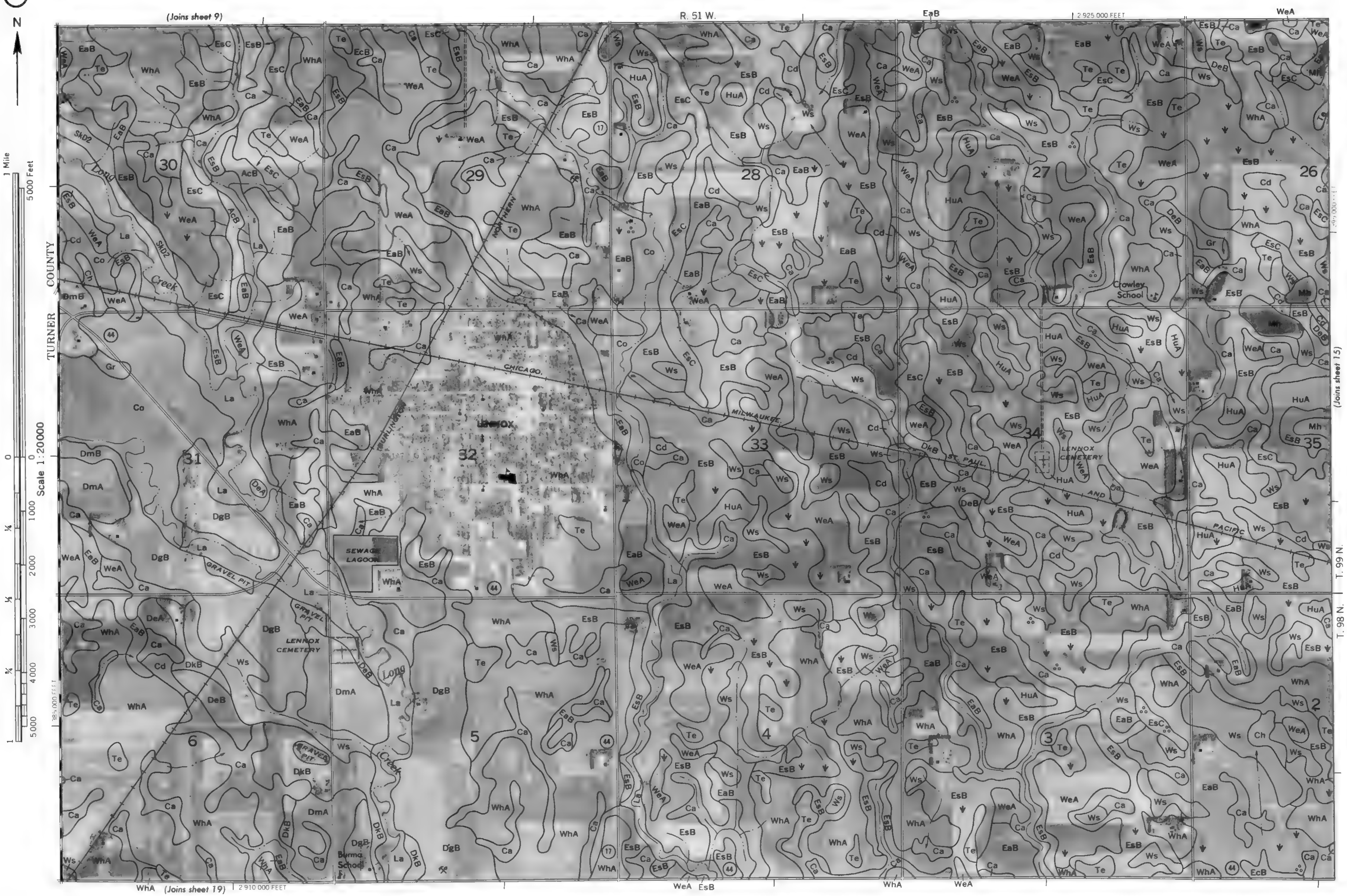

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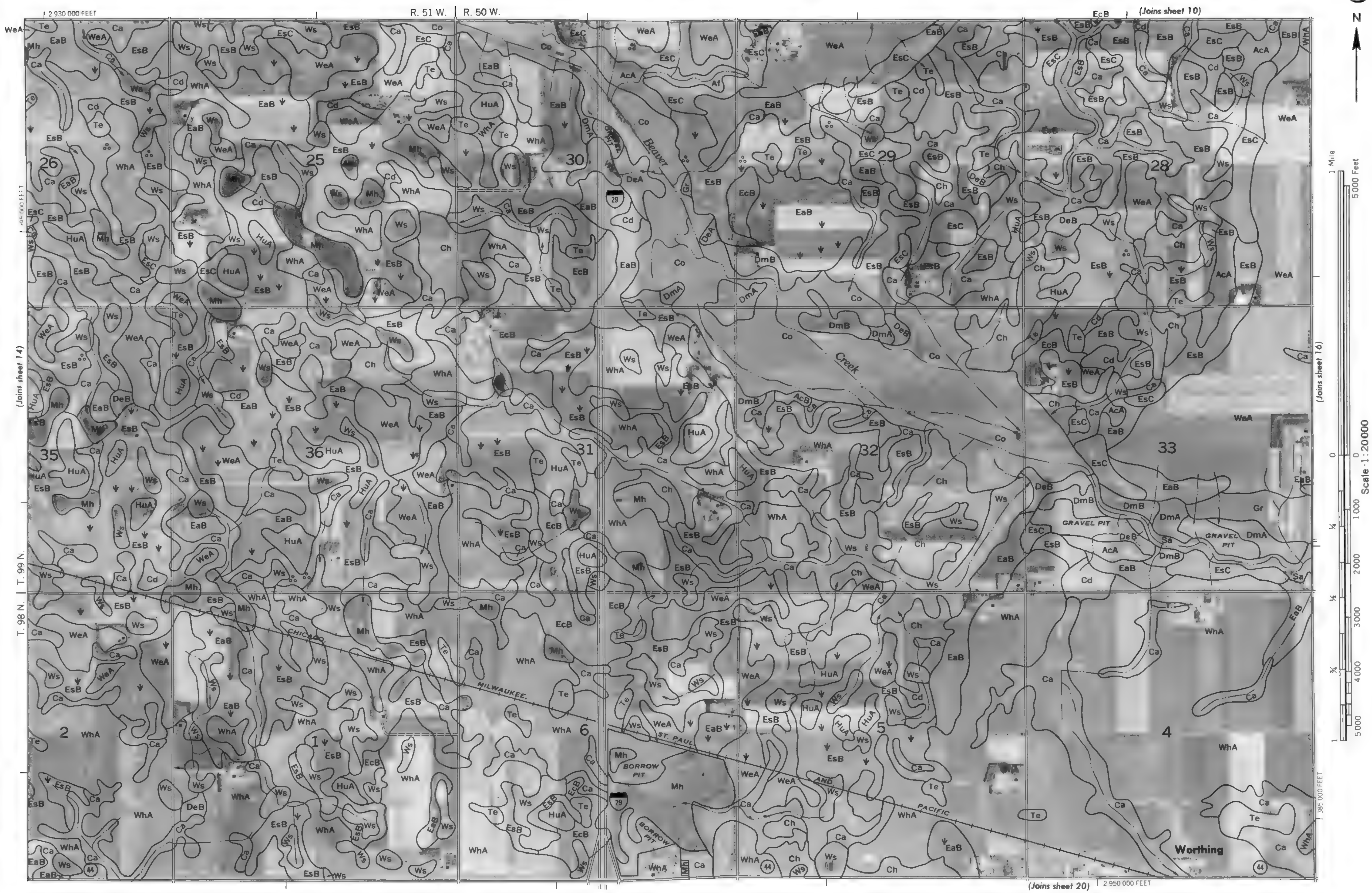

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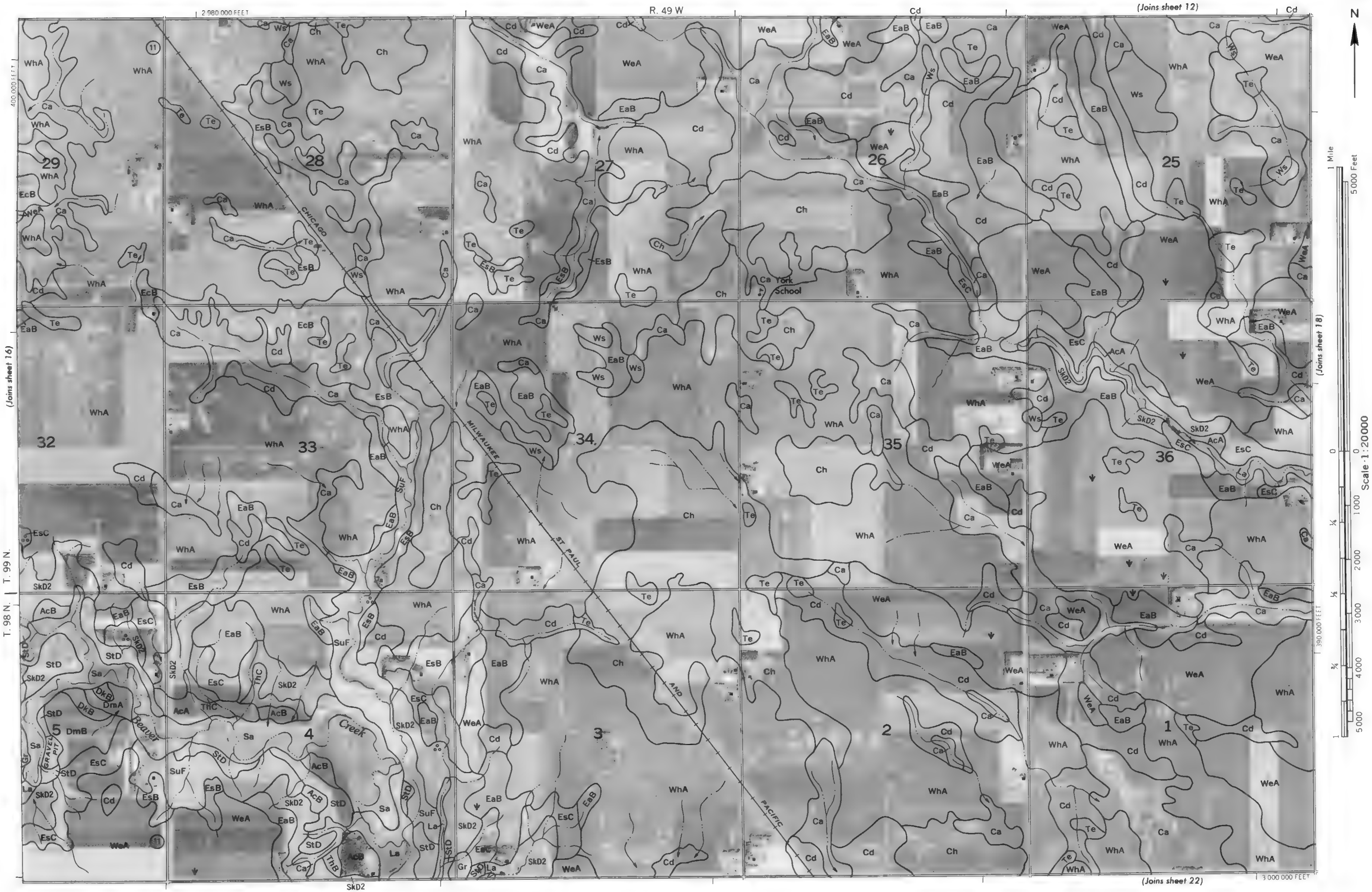

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LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 2

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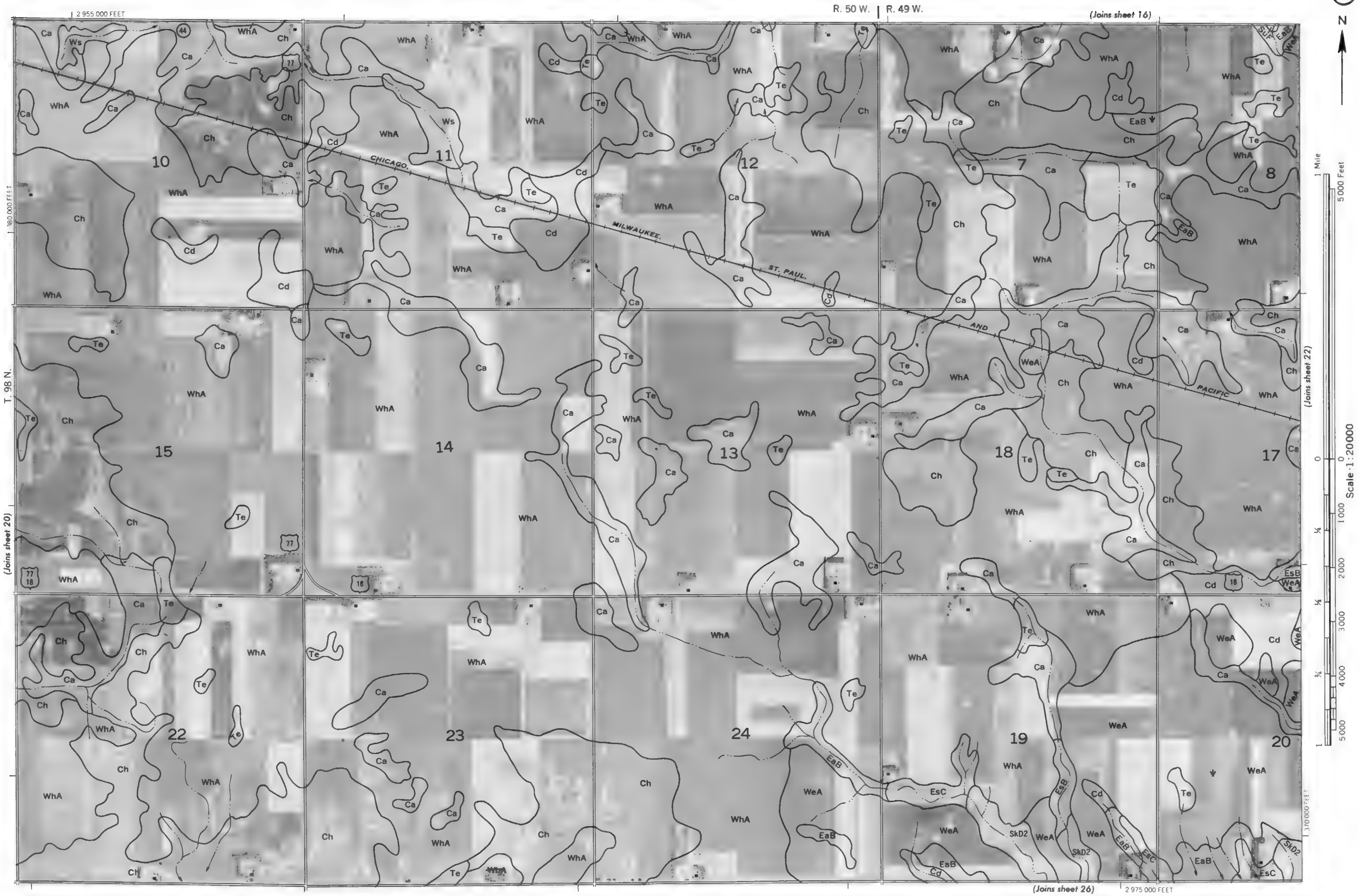

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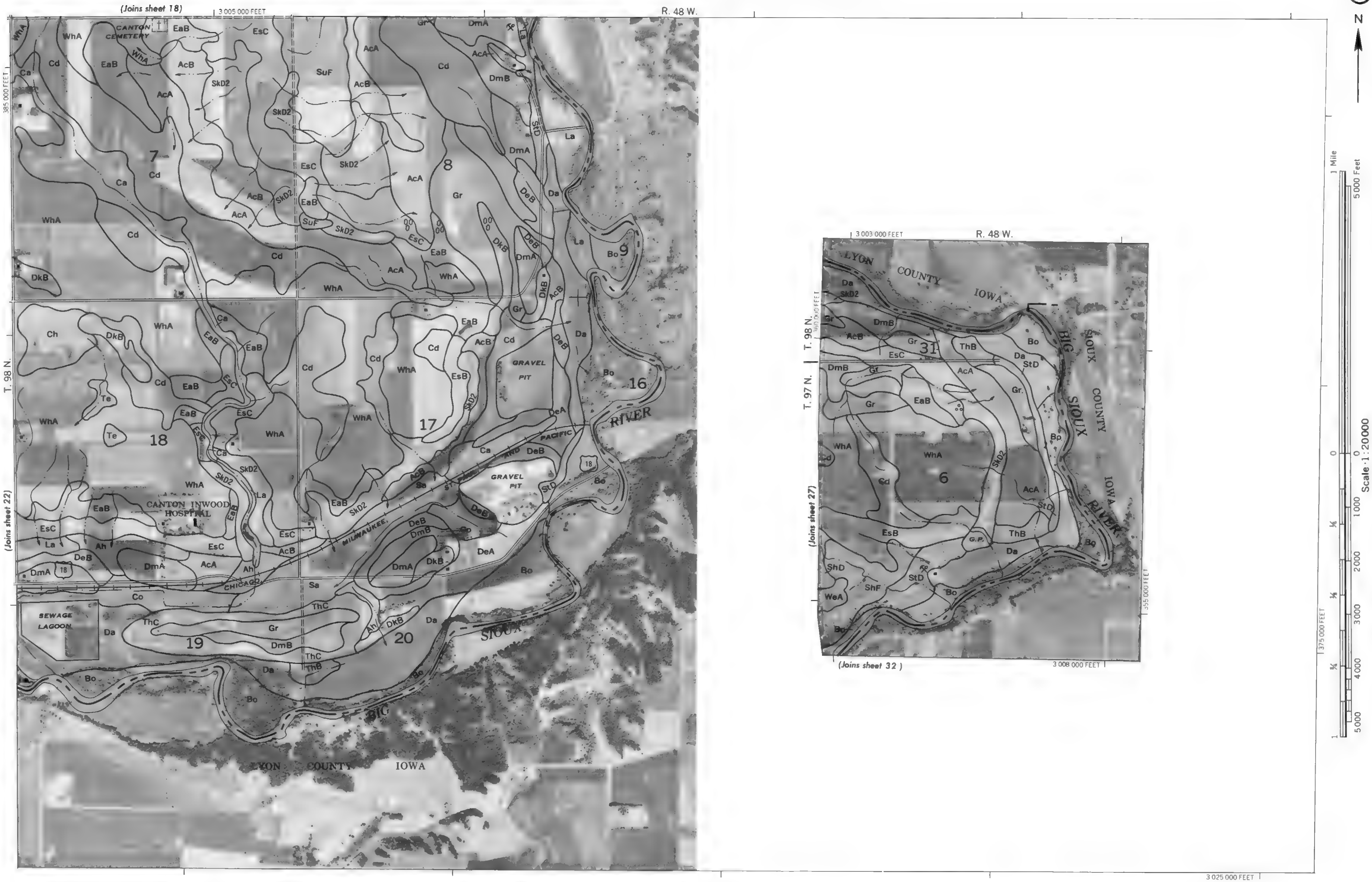

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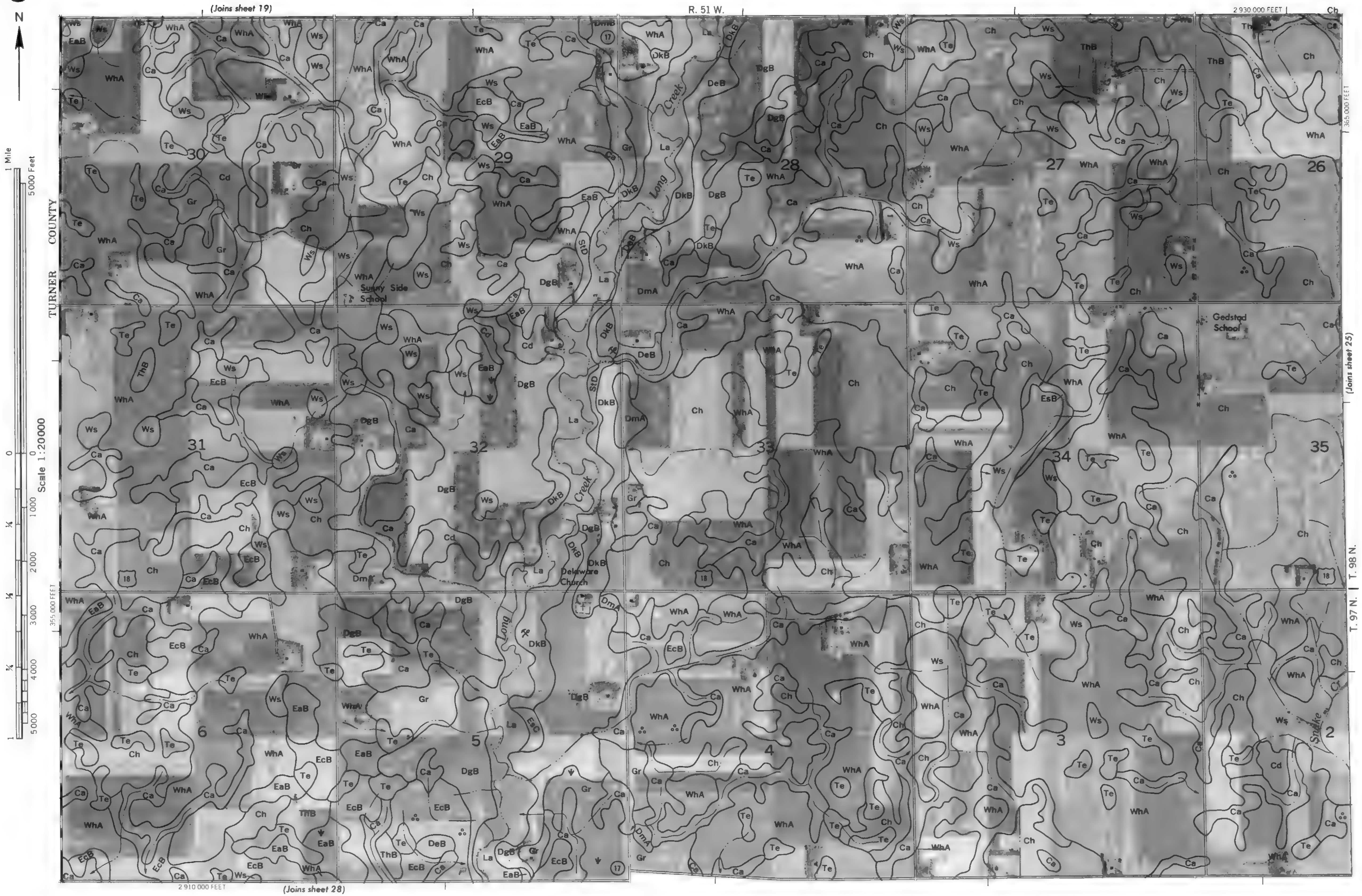

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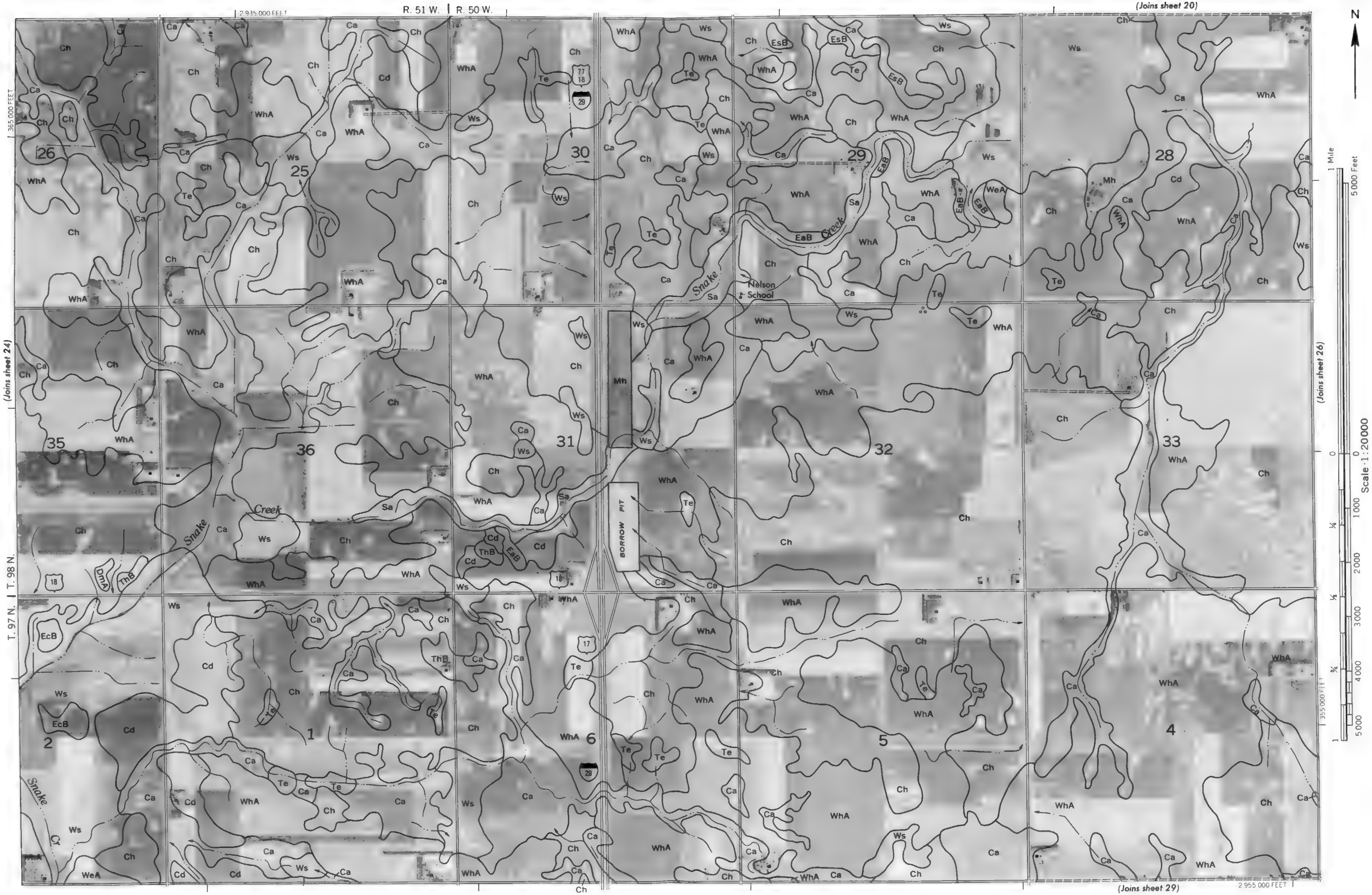

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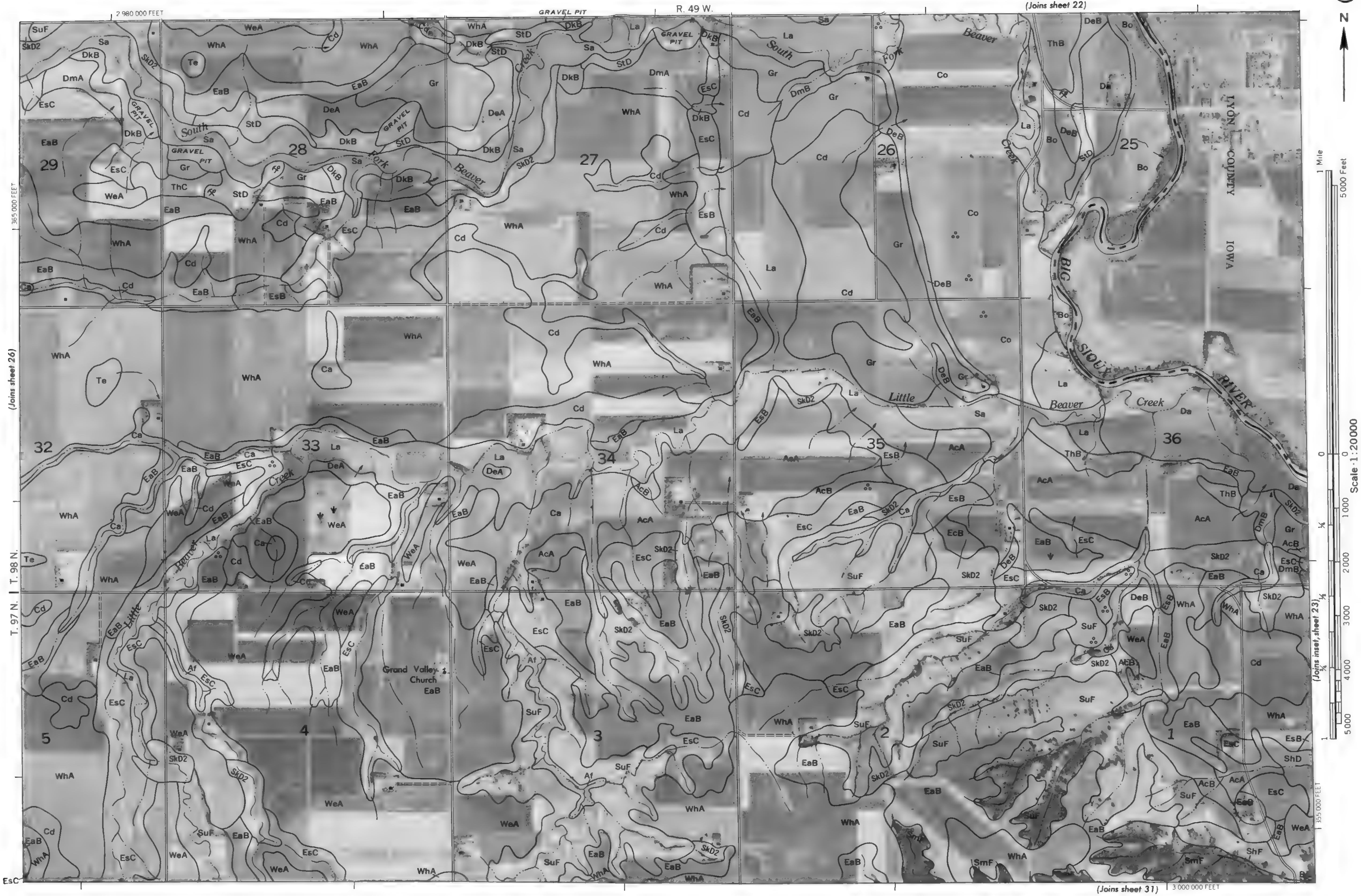
27



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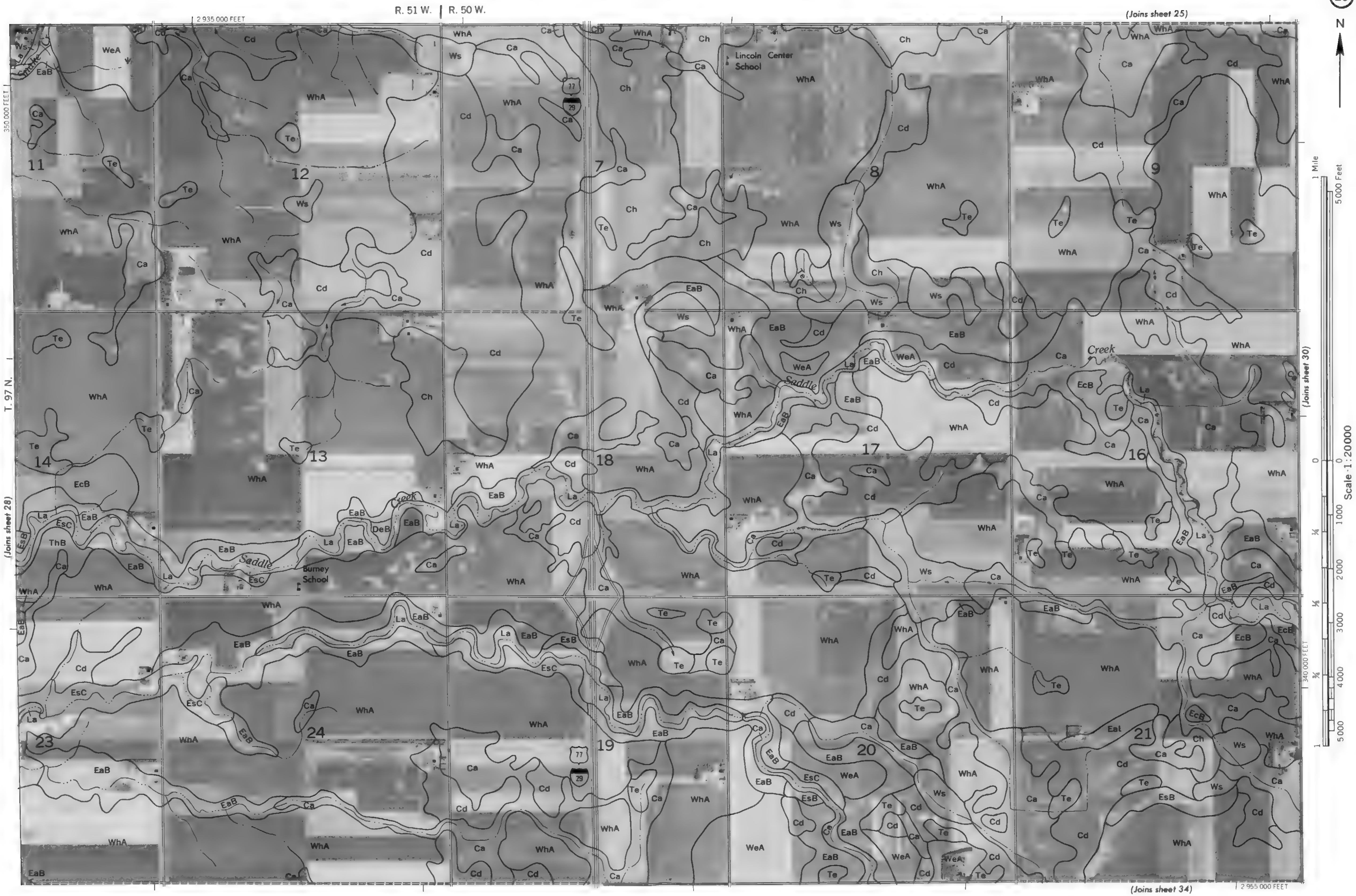

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LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 30

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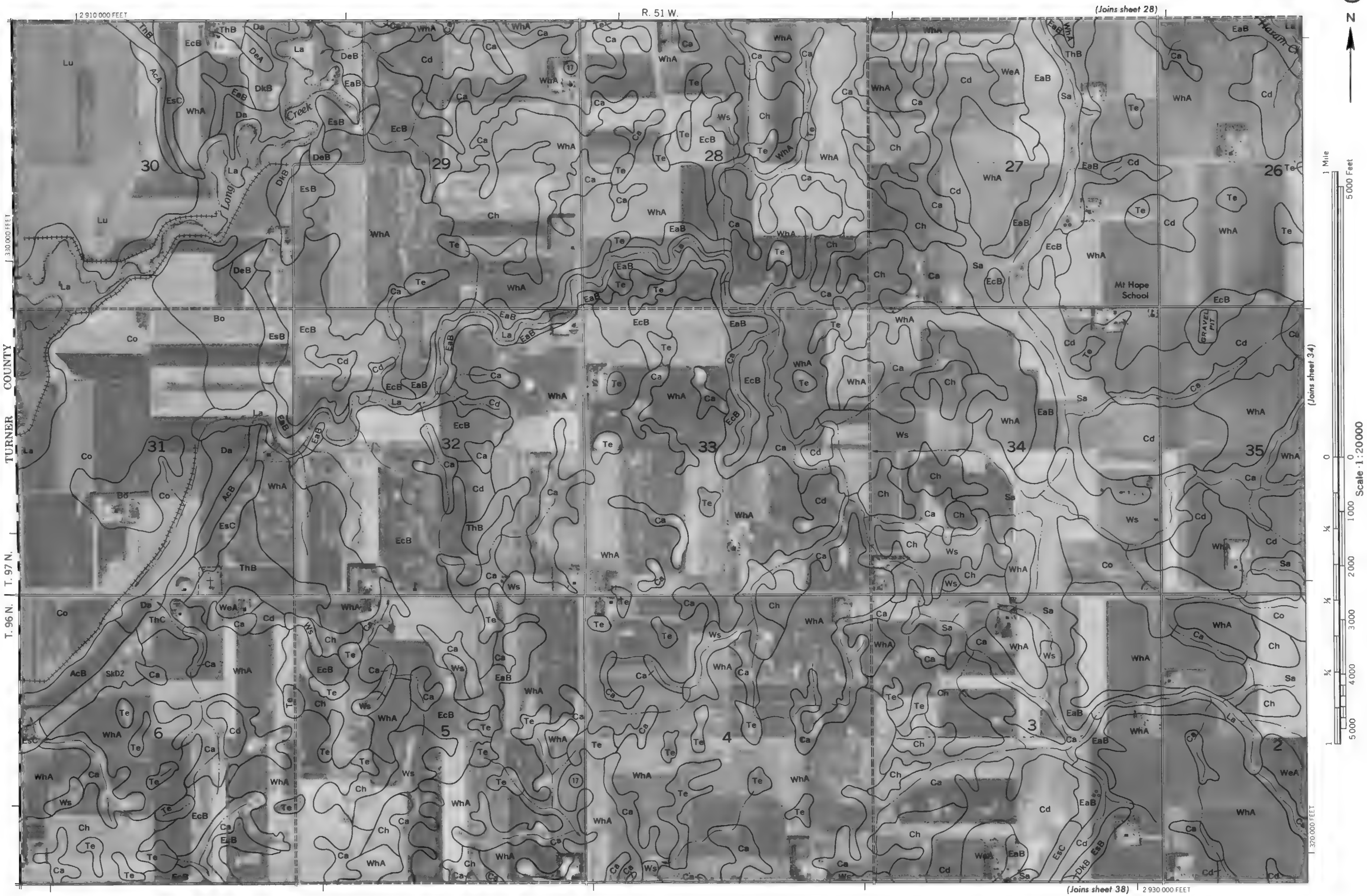

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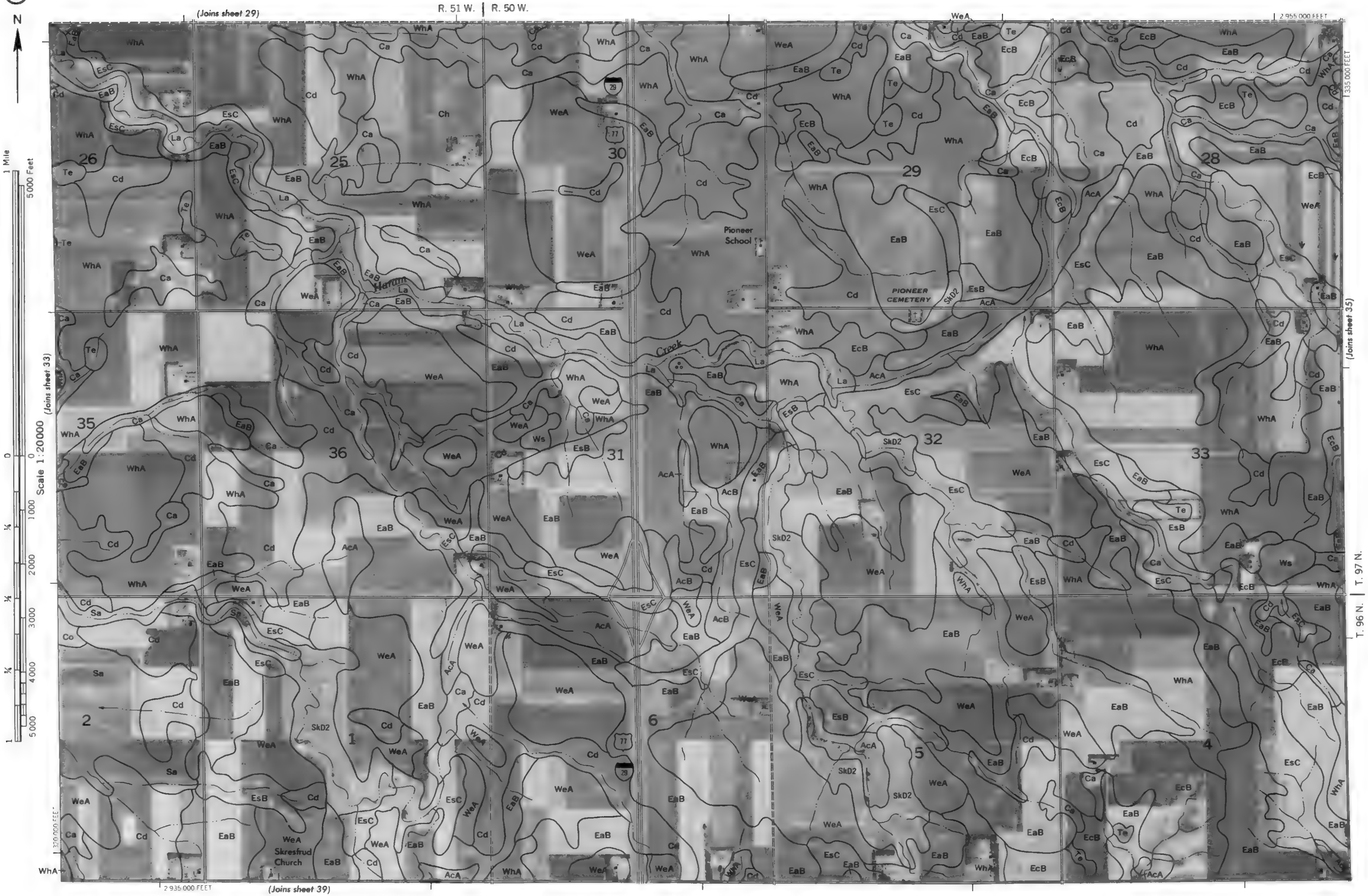

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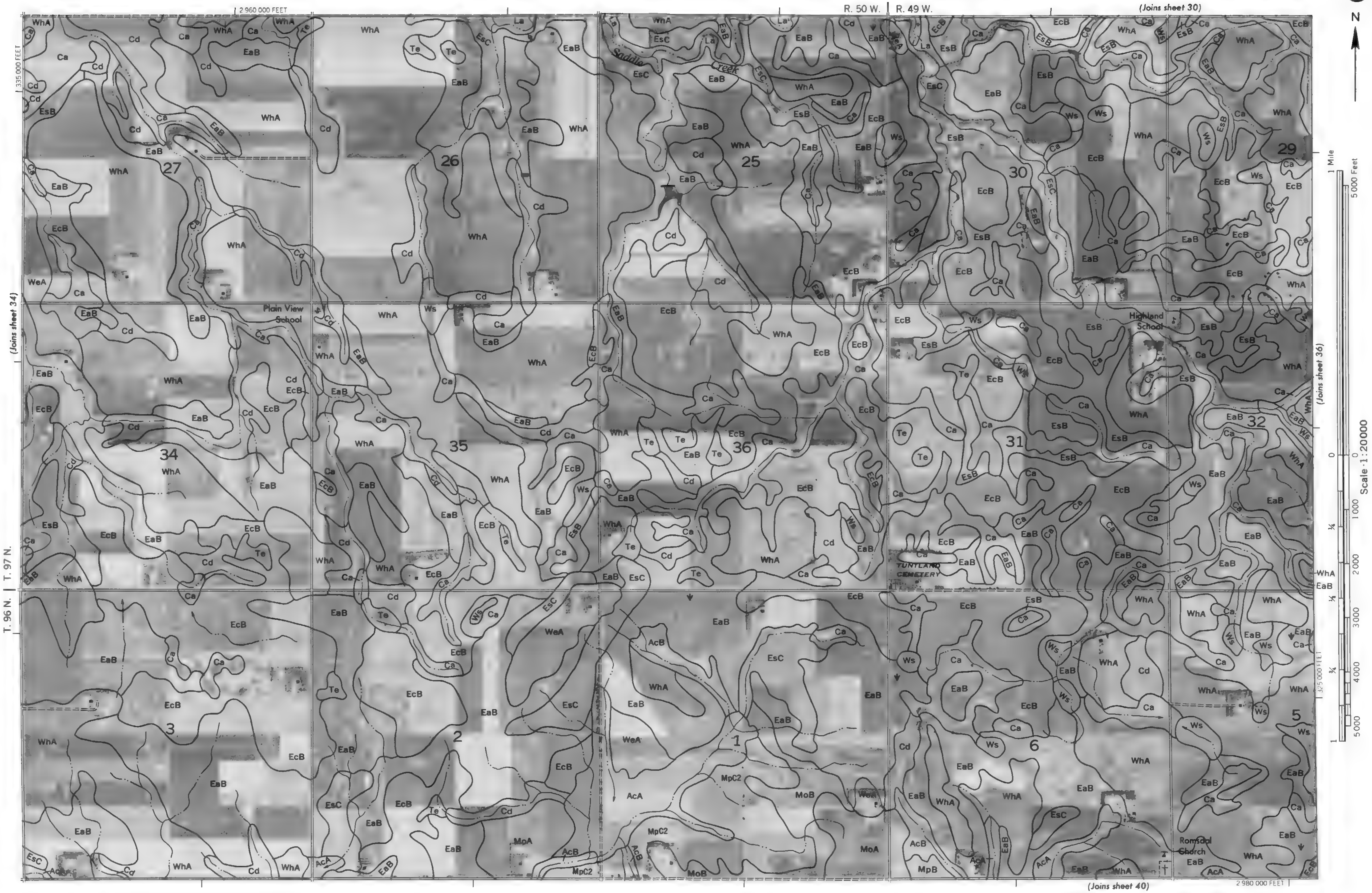

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LINCOLN COUNTY, SOUTH DAKOTA NO. 38

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LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 4

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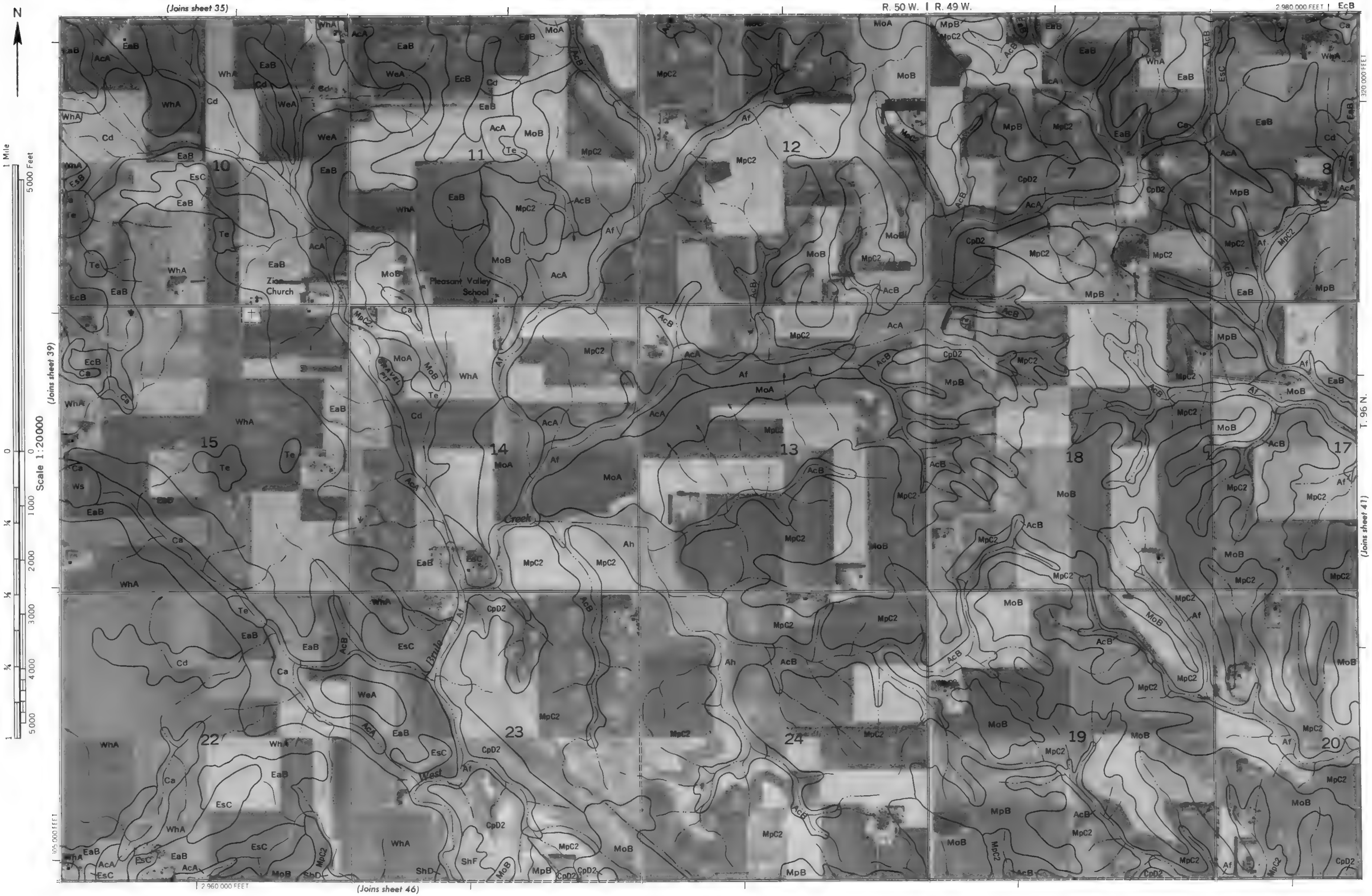
LINCOLN COUNTY, SOUTH DAKOTA NO. 4

LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 40



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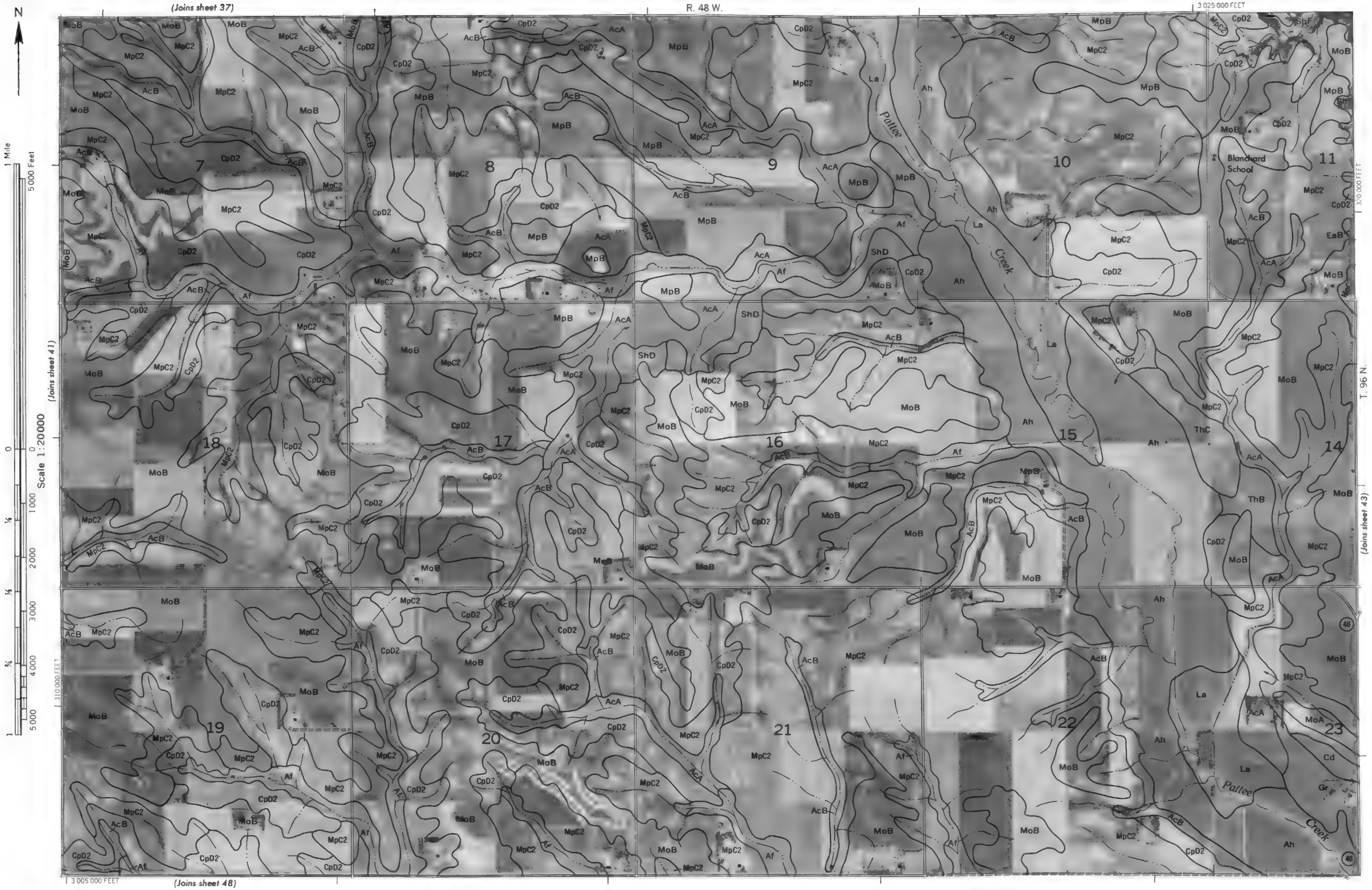

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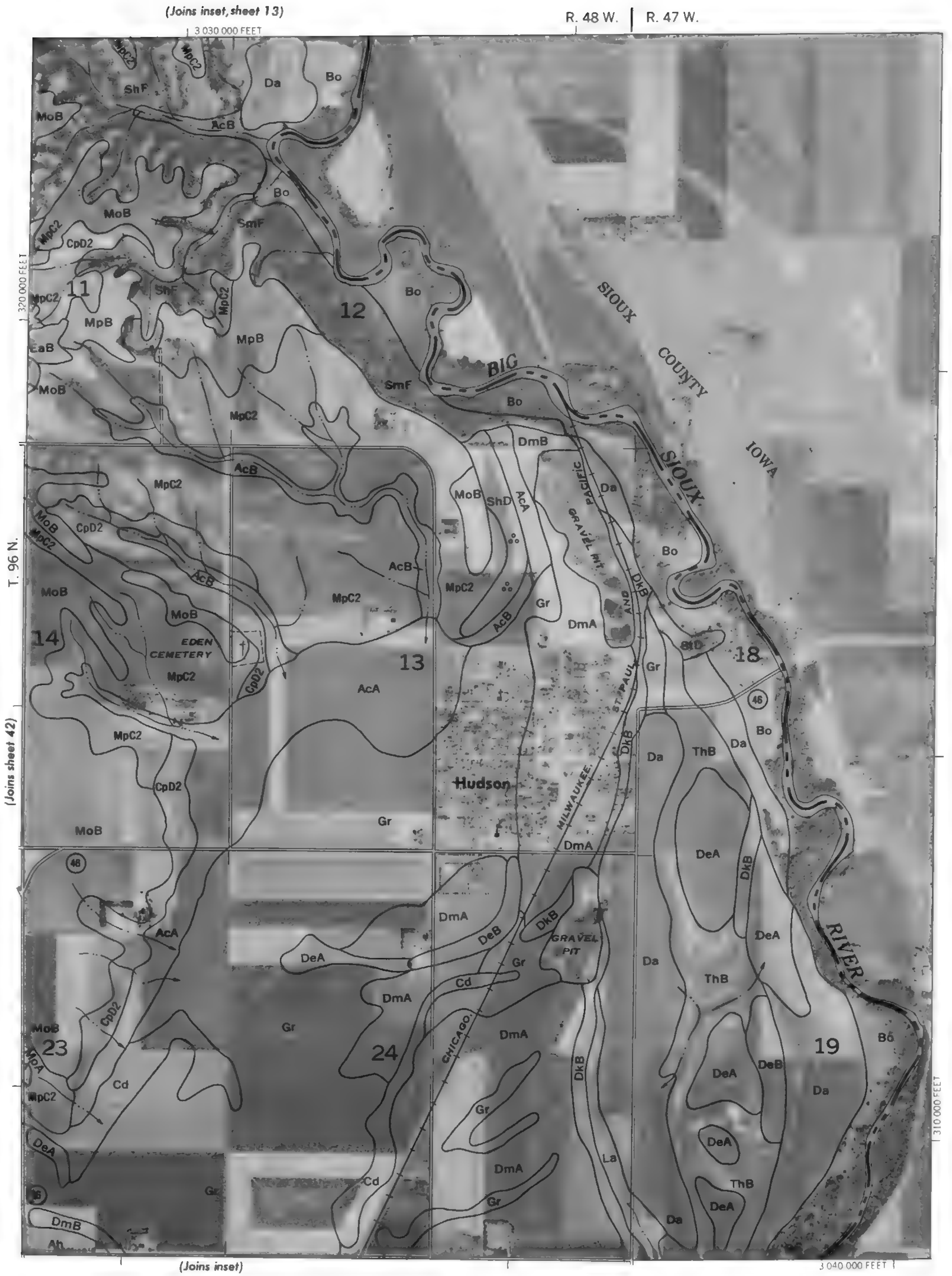

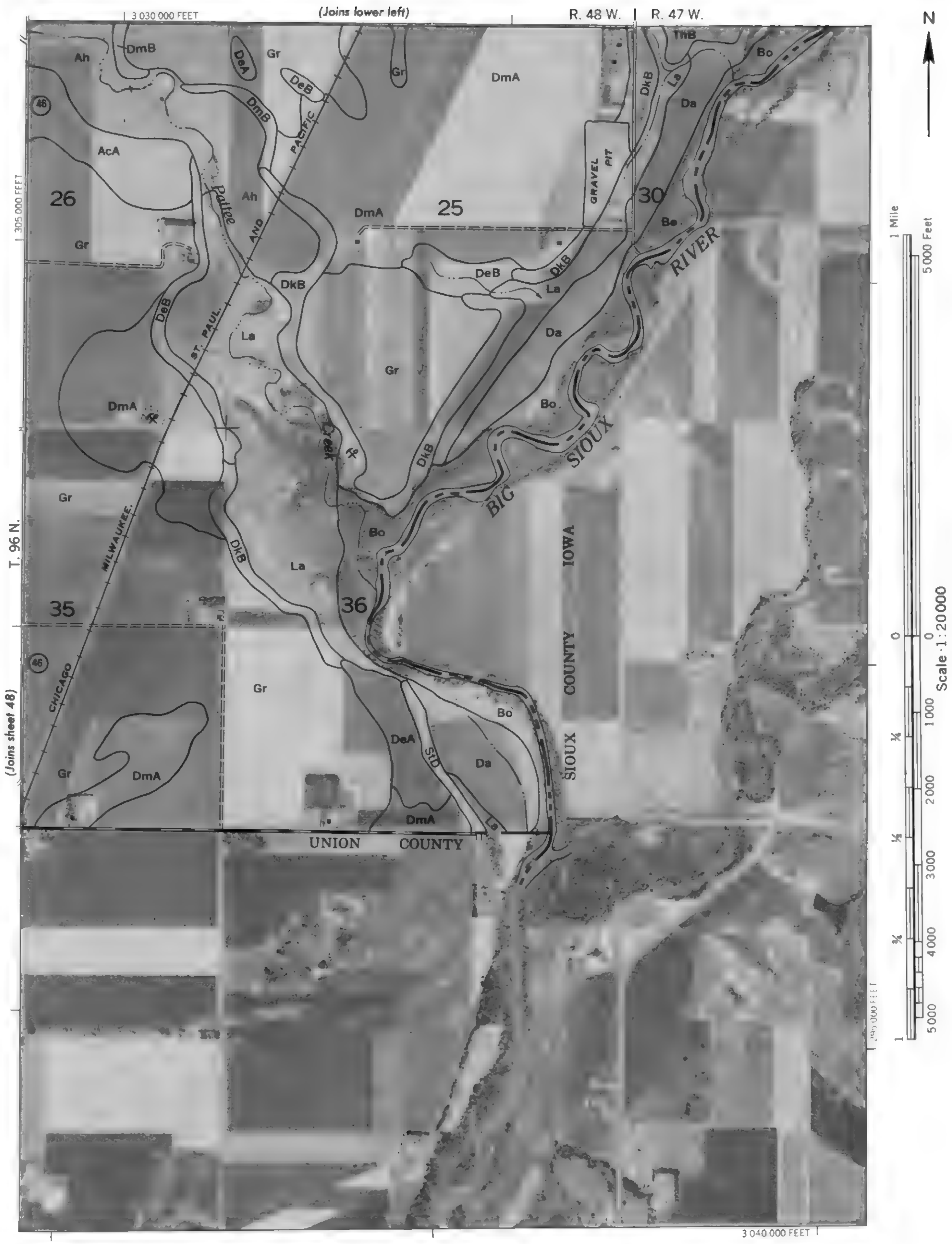

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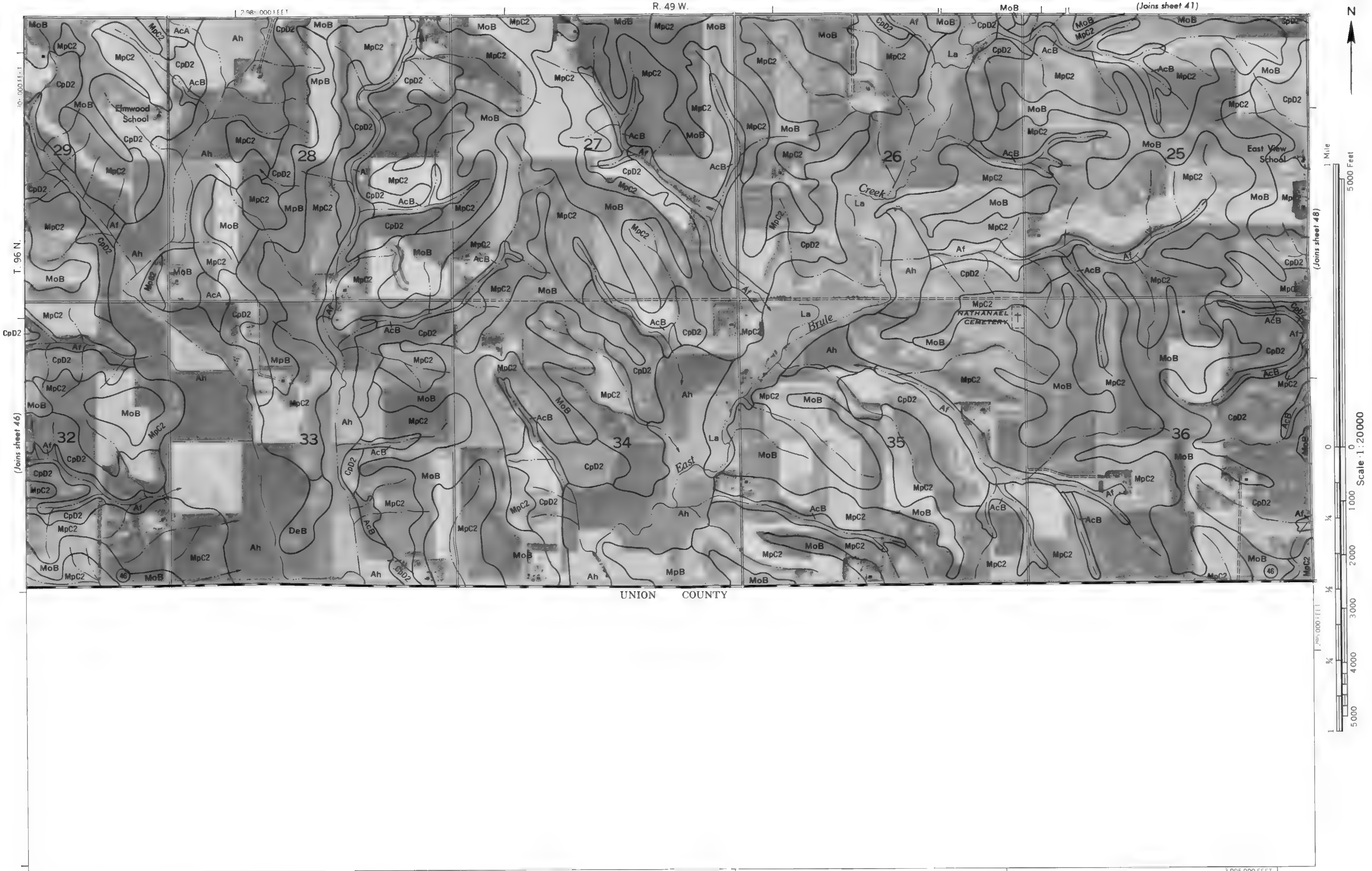
47



LINCOLN COUNTY, SOUTH DAKOTA NO. 47

LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 48

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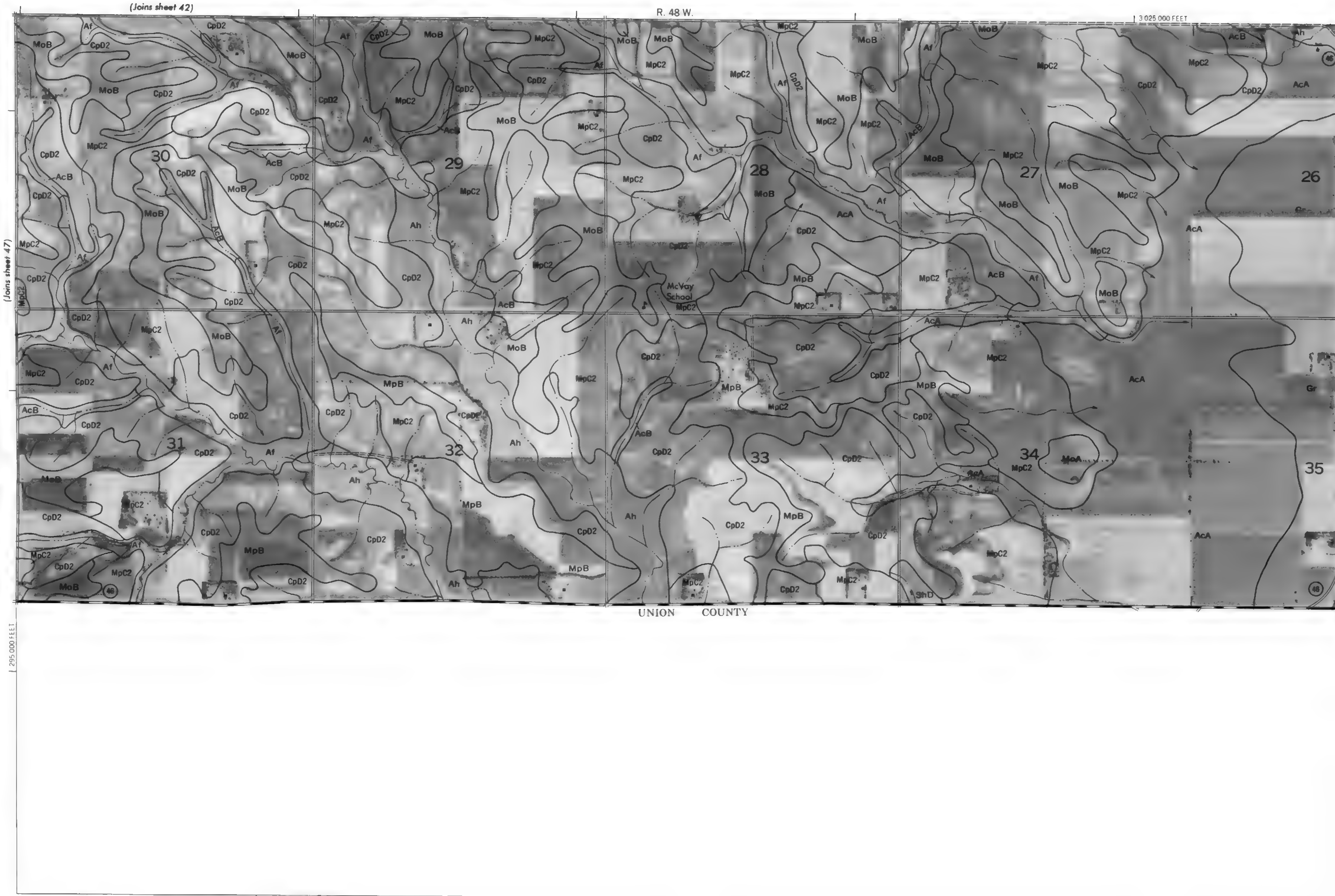

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

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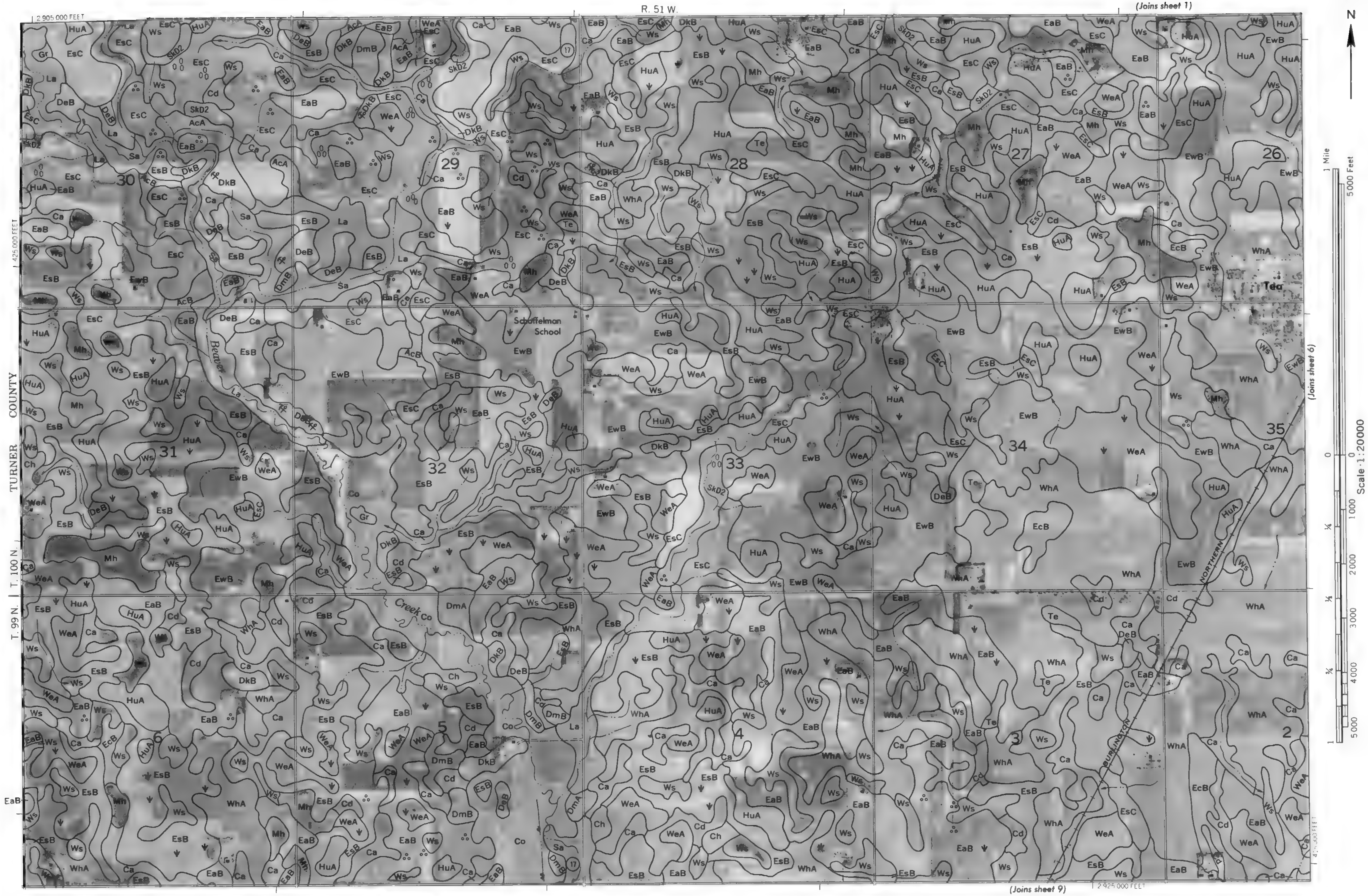
5



LINCOLN COUNTY, SOUTH DAKOTA NO. 5

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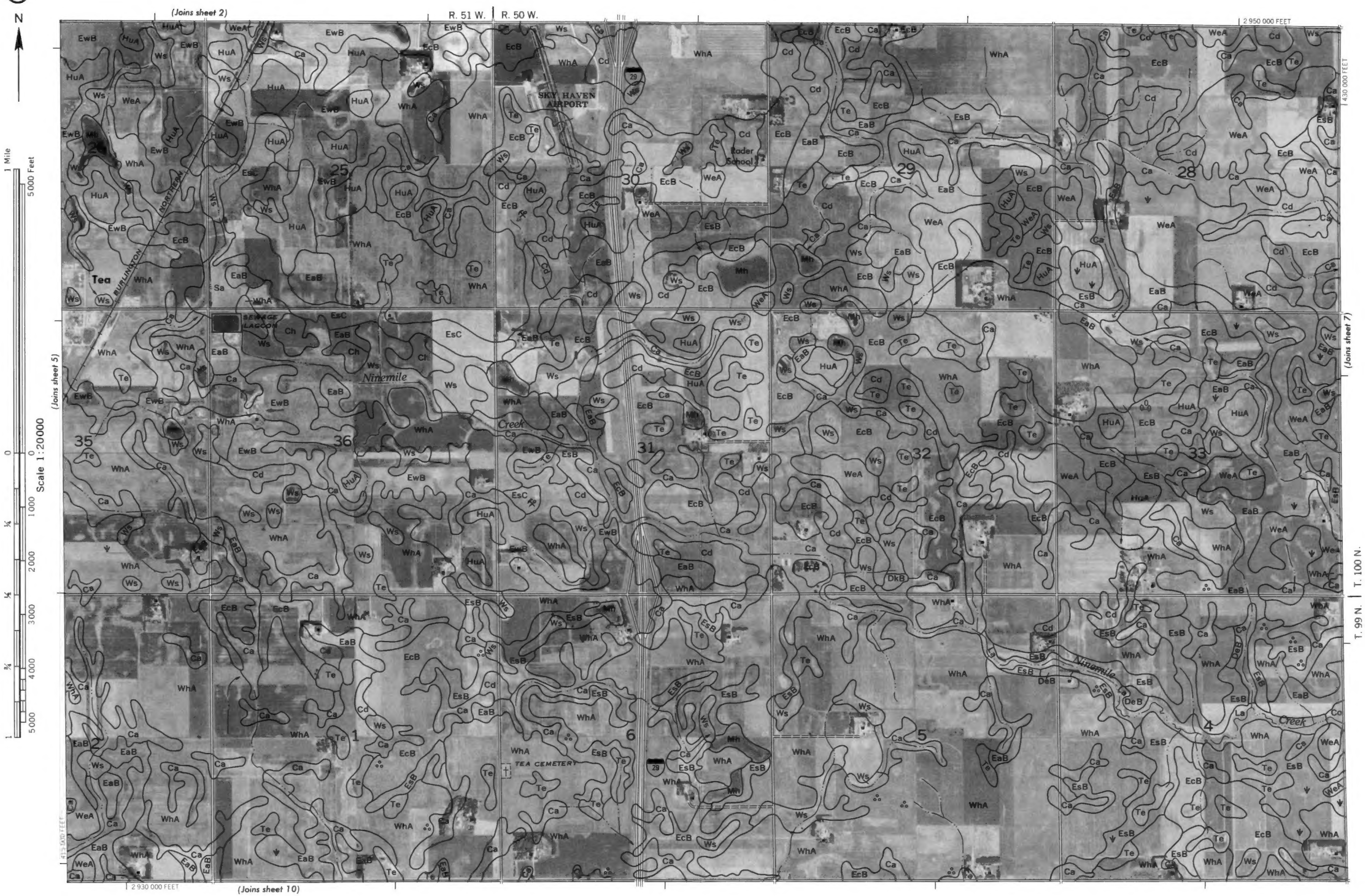
LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 6



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LINCOLN COUNTY, SOUTH DAKOTA NO. 7

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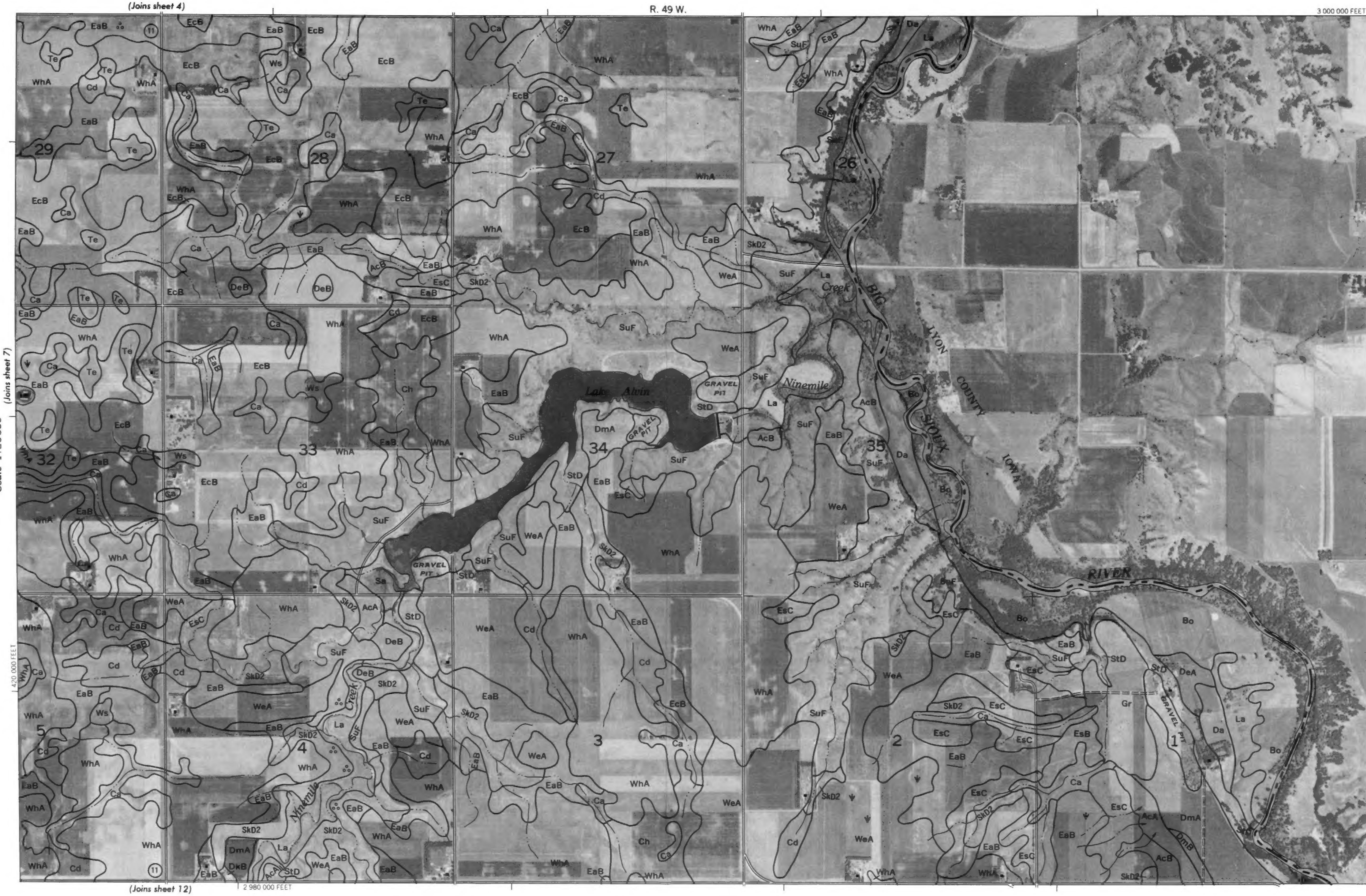
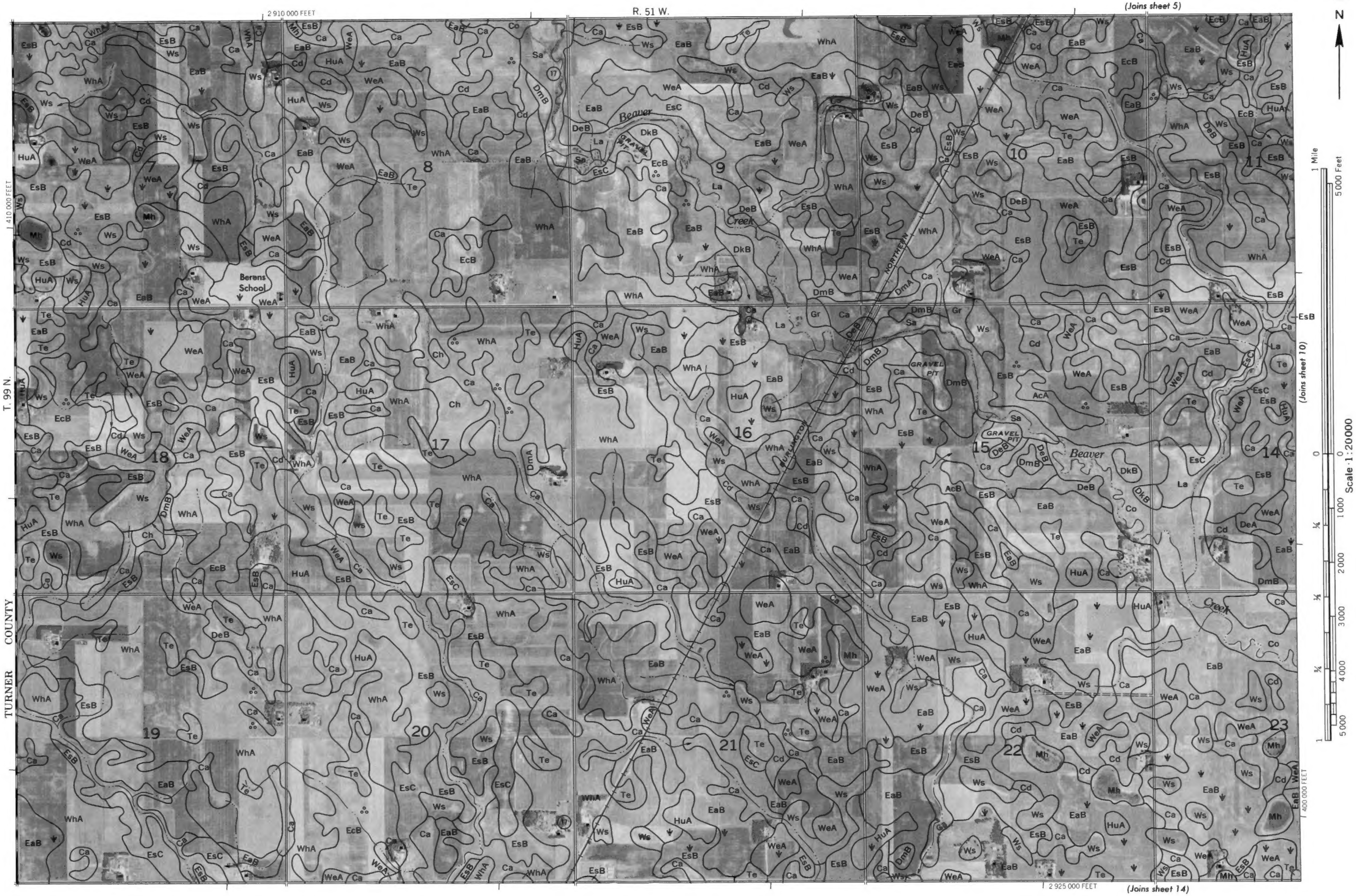
LINCOLN COUNTY, SOUTH DAKOTA — SHEET NUMBER 8

N

1 Mile
5000 Feet
Scale 1:20000
0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 5000 1



This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



LINCOLN COUNTY, SOUTH DAKOTA NO. 9

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